State of H/DTV Technology

Review of a Year of Amazing Evolution

And a Vision to the Future at the CES 2005 Show

By Rodolfo La Maestra January 2005

This report reviews new H/DTV products and the industry in general, and is intended to help consumers on purchases and upgrades of H/DTV technology. The document is a follow up of the CES 2004 report; the majority of the equipment included on that report is still currently available to consumers.

During the year, several announcements and events took place and new models were introduced, such as CEDIA in September 2004; rather than showing a full jump of one year of data from CES January 2004 wrapping at CES 2005, products are highlighted with the date when they were introduced, providing a perspective of their maturity in the market. In addition, products announced at CES 2005 that are planned for release throughout 2005/6, are highlighted at the end of each manufacturer grouping with a CES 2005 legend.

In other words, in order to have a broader picture of all H/DTV products, whether they are discontinued, current, or future (as announced at CES 2005), both reports (2004 and 2005) should be consulted together, and in some cases, even the CES 2003 report. The approach makes this CES 2005 report more manageable to readers that just want to know the future and the recently released products.

Most publications only show current DTV products with basic specifications, they exclude future equipment expected over the next year, and they do not analyze the market to guide the reader in making the right choice. Hundreds of products are included on this report, with specifications and features intended to facilitate comparisons with other models and brands. The report also highlights

manufacturing trends, and the adoption / abandoning of certain technologies (such as the dramatic increase of flat panel displays, LCoS in/outs, etc.)

The report assumes that the reader has basic knowledge of DTV; some of the technical information provided might seem overwhelming to readers that feel the need to understand the basics first. To become familiarized with H/DTV a reader might want to consult sites such as **www.ilovehdtv.com** or my tutorial articles on the HDTVetc magazine **www.hdtvetc.com**

All types of monitors and integrated H/DTVs are covered on this report, including RPTV (rear projection), FPTV (front projection), Direct-view, Plasmas (PDP), DLP, LCD, LCoS, D-ILA, SXRD, SED, etc.

It reviews DTV related equipment such as D-VHS VCR (and D-Theater), High Definition DVD for playback/recording, HD tuners for small-dish satellite, digital cable, and over-the-air (OTA) w/antenna reception, and HD PVRs (Personal Video Recorders also known as DVRs), and the manufacturer implementation of digital video connectivity (DVI, HDMI and IEEE-1394 Firewire).

As with every year, this report excludes DTV displays under 40" diagonal (except for a few mentioned in the LCD-TV group), computer related HD-tuner cards, computer Hard Disk Drives (HDD) for HD video storage (similar to an HD Tivo PVR, but using a computer), C-Band (big dish) satellite equipment, and some after-market modifications to HD-Set Top Boxes (HD-STBs) for DBS small-dish satellite HD recording (such as 169time.com).

All the information about models, prices, and specifications has been confirmed with product demonstrations, lab tests, industry press releases, technical articles, and manufacturer interviews at CES. Although considerable effort was made to consolidate and verify the correctness of the data, I cannot assume responsibility for omissions or errors. Any information you might want to contribute to correct or enhance the usefulness of this report would be certainly welcomed.

Let us get started.

Why CES?

Consumer electronics is always very dynamic. Some manufacturers release H/DTV lines with important upgrades once a year while others introduce new features and improvements several times a year, both have the potential to affect your purchasing decisions.

The International Consumers Electronics Show (CES) is probably the most important event for that industry; many new products and prototypes are shown by manufacturers, some might never be released. CES International is held every January, and has grown from 200 exhibitors/17,500 attendees in 1967 to 2,550 exhibitors and 142,585 attendees in 2005 (10,000 more than 2004).

CES **www.CESweb.org** is now over seven times the size of the Custom Electronic Design and Installation Association Show **http://www.cedia.net/** CEDIA EXPO (with over 20,000 attendees) in September, another opportunity to witness the introduction of future products.

Many people attend CES to plan their future purchases and start saving for products that would be released months or years later; or to acquire a current product because CES helped them confirm that it might not be worth the waiting.

However, many major companies (such as Sony, Toshiba, Hitachi, Mitsubishi, Thomson, and Samsung) are known to introduce the details of full lines of new products on the first or second quarter of each year, products that might have not been even hinted at CEDIA or CES. Those products will be included in the next "State of H/DTV report" as part of the events of the year 2005 closing with CES 2006.

Prices are shown as MSRP (rounding the 999s to the next dollar to facilitate reading). Product release expectation is stated as TTM (Time to Market) or TBA.

As the industry grows in complexity, variety, and number of products, the work to cover and analyze all the H/DTV industry during the year and at CES is becoming an overwhelming task year after year. Nevertheless, maintaining the broad scope facilitates linking the pieces together to offer a deeper analysis with a wider perspective for the readership, rather than just showing individual new products as most magazines do. Should you have any comments or questions please feel free to contact me at **rodolfo.lamaestra@verizon.net**

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For additional information on H/DTV equipment or tutorial articles, please consult:

The State of H/DTV and CES 2004 Report available at **www.ilovehdtv.com**, which includes the following subjects (not covered on this 2005 report):

HDTV Integrated Tuners
DTV Over-the-Air ATSC Tuners
DTV Cable-tuners
How the Cable Plan was approved in 2003
CableCARD
Broadcast DTV Regulations Recently Approved
HD-STB vs. Integrated Tuners
- Cost and Technical Considerations
- HD Tuning Capabilities
- Backward Compatibility with NTSC Equipment
- Upgrade Capabilities of Cable Tuner/s (and Integrated HDTVs)
- Analysis Summary

Comparison Table of Monitors and Integrated HDTVs

The CES 2003 report for equipment not covered on 2004 and 2005:
http://mysite.verizon.net/rodolfo.lamaestra/index.htm

Tutorial articles published on the HDTVetc Magazine, at **www.hdtvetc.com**

Buying a HDTV, issue # 2
HDTV Integrated Tuners and you, issue # 2
The Current State of HD Technology, issue # 3
HDTV Copyright Issues, issue # 4
New HDTV Products – Looking into the Future, issue # 7
Is HDTV Complex Enough?, issue # 8

Highlights of CES 2005

During the Year, Before CES

The High Definition DVD format wars and the Hollywood Studios showing their non-exclusive support to either side have started to become more public, and worrisome. The first large LCD panels were shown last year at CES 2004, and by year-end 1.4 million LCD panels were sold; 290,000 LCD panels were sold in October alone. 2004 was also the starting year of the market attraction for panels.

2004 also showed considerable public interest in H/DTV with 7 million sets sold, 14 million sets were sold in total since November 1998, representing 23 billion dollar sales; 4 million of those were sold on the first four years (99-02), another 3 million in 2003. In summary, 2004 sold the same as 99-03 together.

The last two years were remarkable for the growth; it appears that consumers are becoming more interested in H/DTV for the purpose of watching TV, not as the interest of early adopters in experimenting with the groundbreaking technology between 1998-2002.

After CES

CES showed that 2005 will be the year when 1080p display started to compete. Perhaps, content and distribution will equally be motivated to reach that level of quality, such as Hi Def DVD before in late 2005 / early 2006. More efficient compression algorithms like MPEG-4 AVC are making possible not only High Definition DVD, but also the expansion of HD satellite services and more HD channels, as it was recently announced by DIRECTV, Dish Network, and Voom.

Should quality be an objective (rather than multicasting DTV SD channels), the more efficient MPEG-4 compression has the potential to facilitate the distribution of 1080p content (at 60 frames x second) using a similar bandwidth allocated for today's 1080i (30 frames per second interlaced as 60 fields).

Although the ATSC standard does not include that level of quality, the potential could be applied for other services than over-the-air. New 1080p sets, if designed to accept a 1080p signal, would be in a good position to display at that potential. Read more in the highlights and later on the report.

In 2005, panel prices will come down at a faster rate relative to other types of displays, and panels will be more common at larger sizes, such as 70+ and 80-inches plasmas, and even a oversized 102" model expected within two years. LCD panels are joining the 40" plus domain of the plasmas, with 40 to 65 inches from many manufacturers. CES unveiled a good number of these oversized panels. HD-DVRs are becoming to appear integrated within some TVs and plasmas, small portables, in addition to HD-STBs for cable, over the air, and satellite.

The report includes a large number of new products and technologies; the following pages are just a highlight of CES 2005:

LCD-TV Panels will be coming in 57" from Samsung, TTM Jun 05 ($16000), 1920x1080p, integrated with ATSC/QAM CableCARD tuners, 1000:1 CR, DNIe, AnyNet home-networking, 600 cd/m2 brightness, 6.2 million color capacity, response time faster than 8 ms, an improvement from the 12 ms of their 46" model 468W introduced 6 months ago, not to mention the comparable improvement over the 20ms+ of many other LCD products.

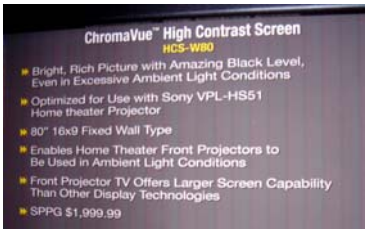
Samsung 57" LCD-TV

Below on the right, is the impressive prototype shown at CES of the Sharp AQUOS 65" LCD-TV panel, TTM 2H05, $TBA, 1920x1080, integrated ATSC/QAM CableCARD tuners, Quick Shoot video circuitry for 12 milliseconds response time, HDMI, IEEE1394, and DVI-I.

Below, LG's 55" LCD RU-55LP10, $TBA, TTM May 05, 1080p, ATSC/QAM/NTSC tuners.

Sharp AQUOS 65" LCD-TV

Sony introduced the Black 80" Front Projection Screen (HCS-W80, $2000, TTM summer 05) designed for daylight operation, reflecting only red, green, and blue wavelengths with a 2.1 gain, and absorbing all ambient light in the room.



SONY Black Screen HCS-W80

A number of new 1080p microchip 70" RPTVs was shown in DLP, D-ILA, and SXRD technologies. These HDTVs upconvert 480i/1080i signals to their native 1920x1080p resolution, they do not accept 1080p. Some of the RPTVs shown were: Samsung HLR7078W DLP (TTM Jul 05, $8,000), TI DLP (concept demo, not for sale), Sony LCoS SXRD KDS-70Q006 (TTM Jan 05, $13,000), JVC LCoS D-ILA HD-70FH96 (TTM Sep 05, $9,000), LG had another set as well, etc.

I used the opportunity to perform some recurrent viewing over the four days at CES. I found the TI set as the best of the group (but it is not for sale), followed closely by JVC's D-ILA, but not as closely by Sony and Samsung in a tie, although the last two were not shown in dedicated rooms as the first two.

TI built and calibrated their demo set (left) as a demonstration of the level of quality that other manufacturers could also reach using the xHD3 technology, if also using good optics, engines, color wheel, etc.

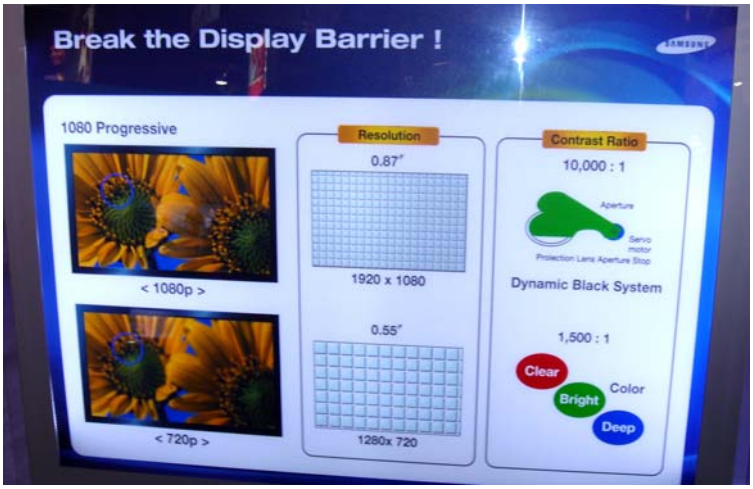
JVC's D-ILA produced crisp images with excellent blacks, whites, good rendering of all colors, well resolved image, and faithful to fast motions of dynamic scenes.

The Samsung 70" DLP set below to the left was also shown in an open area.

The Sony SXRD on the right was shown in a large open room; it appeared as the contrast, sharpness, and edge enhancements were excessive; some artifacts could be attributed to the source material.

It seemed that the Sony set was not ISF calibrated, and that it could have shown better in a more appropriate environment; the set deserves another viewing opportunity. Sony includes this set now as part of the QUALIA line for $13,000; the set was initially introduced a few months ago as part of the XBR line for $10,000.

A 1080p vs. 720p demonstration was made by



Samsung (below). New 1080p TVs include proprietary de-interlacers that usually are not as good as external scaler/video processors. Considering that in the near future there might be 1080p sources, such as High Definition DVD for film content, the feature of accepting a 1080p input might become important for a TV of this level at that time.

Accepting 1080p externally will also permit the connection of a higher-quality 1080p video processor, such as Faroudja, DVDO HD+, and Lumagen video processors, or the soon to be available "Dragon Fly" scaler/noise reduction processor. The unit implements the new Silicon Optix/Teranex "Realta" HQV (Hollywood Quality Video) chip, a programmable DSP that can perform one trillion operations per second.

The new HQV chip upconverts 1080i to 1080p at up to 120 fps, has received four awards since its introduction in 4Q04, and the Best of Innovations CES 2005 award. The technology HQV was developed by Teranex, a company that was later acquired by Silicon Optix. HQV has been used in professional products costing $60,000 and up. It employs pixel-by-pixel processing, scaling, detail enhancement, and is fully programmable and capable to receive future firmware upgrades.

Ray Lego, Product Manager of Teranex Business Unit at Silicon Optix Inc, and by Menno Stoffels, Director of Systems Engineering of Silicon Optics Canada Inc. demo the product with impressive results on video comparisons at CES 2005.

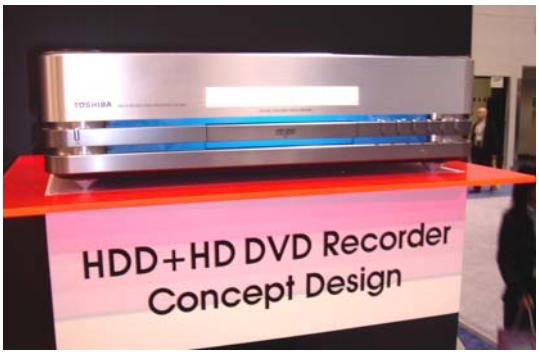
The chip will be offered to interested manufacturers. According to Mr. Michael Poirier, VP of Sales and Marketing of Algolith, the manufacturer of the "Mosquito" product, the company is working to release a scaler/noise reduction processor mentioned above by Jun/Jul 05 at a $3499 MSRP. The unit outputs 1080p/60 frames x second (from 480i to 1080i inputs), but would probably output also 24 and 30fps, if added into the design by the time the unit is released to the market.

The High Definition DVD war is warming up and CES has shown units from most major companies, such as JVC, LG, Panasonic, Philips, Pioneer, Samsung, Sharp, and Sony with their HD Blu-ray DVD ROM players and BD-RE recorders/players; and Toshiba and Sanyo their HD DVD format versions.

Over the last 4 years, many prototypes were shown at CES but no production unit was released within the US market yet, although there are three released in Japan already, and several in China using the EVD format (among other formats they have). Most HD DVD and Blu-ray manufacturers are now announcing that their products will be introduced by year-end 2005 or early 2006.

Regarding component analog outputs, no confirmation was provided if they would be allowed to carry 1080i HD in addition to DVI and HDMI, the preferred secured uncompressed HD connection. Nor was confirmed if 1080p would be implemented on discs and players, however, most High Definition DVD companies at CES stated that content originating from film would most probably be recorded as 1080p/24fps in the Hi Def pre-recorded discs, but that decision would be made by the content providers.

Actually, the content would probably be stored as 1080i interlaced with flags to reconstruct the progressive cadence of film for progressive output connections, similar to the technique of regular DVD for 480i and 480p with film content.



Toshiba HDD + HD DVD Recorder


JVC Blu-ray DVD Combo ROM

Check the details of the High Definition DVD coverage on the dedicated section in page 97.

For its second year, Voom performed the demonstration of their 580 STB/server, now planned for release for mid 2005. Unfortunately, the DVR was demo with no IEEE1394 outputs, which would have allowed HD D-VHS archival/home-networking maintaining the signal in the digital (compressed) domain. A year ago at CES 2004, Voom said it would provide such connection. Apparently, Voom is following the steps of DIRECTV and now Dish Network (covered further down) regarding that matter.

Voom HD-STBs (580 and 550) will be MPEG-4 upgradeable via a Voom supplied card that would be inserted on a slot accessible by opening a small plastic door on its right side. Further MPEG-4 software upgrades would be seamlessly installed as firmware downloads sent thru the satellite dish.

The small client STBs linked to the 580 server DVR using the coax network will not be available until later in 2005, after the DVR 580 is introduced; however, according to Voom, the current Motorola's 550 STBs can

operate as network clients controlling the 580 DVR functions remotely. The recent sale of some of Voom's assets to Dish Network could potentially affect the plans of new products, additional satellites and channels, and MPEG-4 upgrade.

Dish Network announced the future release of a new HD DVR STB, but also confirmed the discontinuation of the famous PVR-921 and the company plans for IEEE1394 connections, a key feature announced over the past 3 years, and a reason many consumers endured the long waiting.

After the PVR921 introduction in 2004, the IEEE1394 feature was never activated as promised; the feature would have permitted D-VHS tape archival of the HD-DVR's stored or tuned satellite content. The omission of IEEE1394 situates Dish Network on the ranks of Voom and DirecTV regarding that capability, giving an edge to Cable and OTA HD-STBs, which do have IEEE1394 outputs for the archiving of permitted content (under DTCP protection rules).

The new DVR is the Dish Player DVR942 (left), $700 with additional $50 for the dish, TTM Feb 05, 250GB HDD capable of recording up to 25hrs of HD content, or 180 hrs of SD. It features a dual tuner satellite receiver with 2 TV outputs for multi-room viewing, up to 9 days EPG, records Dolby Digital audio, has an ATSC tuner to record OTA, caller ID with history, 2 USB ports for future use, optical audio out, DVI/HDCP, and component YPbPr outputs. The STB is to be offered also for lease at $250 initiation fee (the subscriber must return the box at the end of the service).

To mate the DVR942 Dish Network also announced a couple of portable DVRs (right) that can store in their 20GB and 40 GB memories the content transferred from the DVR942, although at SD resolution. The content cannot be output, is user erasable, and can be played back on their small screens (sizes of 2.2, 4, and 7-inches). Some units feature inputs of Compact Flash cards, IEEE1394, and USB 2.0 to receive the content.

Scientific Atlanta also showed a prototype of a new STB server DVR model, a networking centerpiece that can connect with other STBs from the company via coaxial cable. The DVR (model # pending) has a planned release of late 2005, and will be capable of archiving HD content as a file copy format within a Hi Def DVD disc using an internal recorder. The disc would also be playable on similar models, but not on other players of Hi Def DVD formats (such as Blu-ray or HD DVD). The STB has a QAM Cable tuner (with expected Cable CARD capability when released) and will be available for distribution via cable companies

only; it features IEEE1394, 160GB, and also records DVD-R/-RW dual layer 8.5 GB discs playable on regular DVD players, if the content is unprotected.

Samsung, LG, and Toshiba introduced a new technology that allows a CRT direct-view tube to be manufactured with 30% less depth, Samsung calls it "SlimFit" and already announced a new line of sets called "DynaFlat SlimFit CRT direct-view TV Series", the first set of that line will be a 30" TX-R3079WH, $1,300, TTM Mar 05, 15.5 inches deep, w/integrated ATSC tuner. LG also announced a similar 30" ATSC integrated set for later 2005.

New lines of CRT sets were introduced by several companies, Thomson in particular announced seven new sets w/ATSC tuners that display 480i SD, intended for second rooms; its 27" integrated entry level will be offered at just $269. The company also announced a new line of CRT based RPTVs with ATSC integrated tuners at a price starting at $1,100 (52", 56" and 61" screen sizes).

If you are into video games, you might have interest on a 3-D projection system designed for that purpose; a 3-D RPTV prototype demonstration from LG was shown at CES as a technology statement using a Stereoscopic Projection System. Check the LG displays group for details. Radio Shack and Sears introduced their own HDTV sets in DLP and LCoS respectively, look into the corresponding sections for specifications, prices, and availability.

Regarding large plasma panels, Samsung introduced large plasmas up to 80 inches (HPR8072, $39,000, 1920x1080p, TTM May 05, integrated ATSC/QAM Cable CARD tuners) and a 102" prototype model announced as the largest TV in the world (Z102, 1920x1080, TTM two years, $80,000-$90,0000 estimated MSRP)

Samsung 80" Plasma HPR8072

Samsung 102" Plasma Z102

LG unveiled their 71" plasma model MW-71PY10, TTM Feb/Mar 2005, $75,000, 1920x1080p, integrated ATSC/NTSC/QAM CableCARD tuners, 800 cd/m2 brightness, 1200:1 CR, DCDi, HDMI, DVI, component. These panels are manufactured in limited numbers (5000) and will be distributed in Chicago, Los Angeles, and New York; according to LG, there is already a 3-month waiting list. The

same model is also made in gold finish and paired with a gold finished audio system, the system is offered in Korea for $100,000. A 76" model demo at CES 2004 was not shown this time, and apparently has been dropped from the line. LG and Samsung are the only companies competing in the 70+ inches 1080p market.

LG is incorporating a 160GB DVR in future plasmas (50 to 60 inches) expected by Mar/Apr 05, with integrated ATSC/NTSC/QAM CableCARD tuners, EPG, XG engine, four burn-in prevention processes, 1366x768, IEEE1394, and HDMI/HDCP, check the details in the plasma section.

Read about Toshiba's new SED technology intended to compete with today's panels, examine how it works in the first section of displays (page 32); the company will release a 36" and a 50" model, the latter will be available late 2005 or early 2006 with a resolution of 1920x1080, no prices were disclosed yet. The new technology will offer a performance similar to CRT implemented in a panel of only a few centimeters of thickness, and would be able to operate as fast as 1 millisecond of response time, with 8600:1 CR; prices are expected to compete with LCD panels of similar sizes.

Across the street from the Las Vegas Convention Center at CES 2005 the much anticipated SONY HD Truck was waiting for the delights of the visitors that wanted to see a bit more than consumer products for HDTV. Below are some photos to give you an idea of the professional HD equipment what was on that truck:

If you have followed my yearly coverage on the subject of digital connectivity, you might already know that the number of HDMI/DVI inputs in most HDTV displays is still insufficient to connect several components with DVI/HDMI outputs, reason by which you would need to use a DVI/HDMI switcher or an A/V receiver or Preamp/Processor to perform that function.

Every year I review at CES how manufacturers of consumer electronics are implementing DVI and HDMI on future home-theater equipment. I look mainly into A/V receivers because they are what most people use when centralizing the control of their video/audio system, but I also include preamps/processors for the benefit of the separates-oriented consumers. The future models are covered on the section dedicated to it later on the report (page 113).

At CES, it was noticeable that manufacturers of digital video products are broadly adopting DVI and HDMI connections, such as HDTV displays, HD-STBs, and DVD players with upconversion to HD, etc. Read also about the details of how DVI and HDMI with HDCP were designed for the transmission of protected digital uncompressed HD video, with the added digital multi-channel audio feature of HDMI, all the coverage in the digital connectivity section (page 116). A separate section unveils the subject of the recent claims that HDMI is only being implemented as two-channel audio (page 120).

Although showing an increase from last CES 2004, CES 2005 introduced only a few future A/V receivers with such feature, and those are still top-end (and expensive) models. Some from Denon ($3000 to $6000), Integra Research ($4000), JVC ($3500), Samsung ($5000), etc. Check the details and specifications of those new products, and some of the DVD upconversion players with HDMI and DVI capabilities on the same section later in the report.

Read the coverage about the Broadcast Flag content protection mandate by the FCC; how is being implemented, and what systems were included within the 13 digital content protection technologies approved by the FCC so far, such as CPRM (4C for SD sources), D-VHS (JVC), VCPS (Vidi, developed by Philips and HP for recording DTV broadcast into DVD+R/RW discs), etc.

The report also has a dedicated section to cover the subject of how integrated DTVs that include a QAM CableCARD tuner actually operate only with uni-directional capabilities, which could force a consumer to lease a (bi-directional) HD-STB to been able to use the services of Video-On-Demand (VOD), Impulse-Pay-Per-View (ordering PPV movies using the remote, rather than the phone), and Cable company's Electronic Program Guide (EPG).

In summary, depending how a consumer receives the HD signals, he/she might be forced to pay for redundant or duplicated tuners; most consumers would not have enough information to notice were their additional money went on the integrated solution, unless they read reports like this one.

Check also in the report, how tuner integration is being implemented to comply the mandate of the FCC. CES has shown a massive effort from manufacturers in installing ATSC and QAM Cable CARD tuners in most large TV sets, and it will become unusual to find a monitor version when you find the DTV set you like. As covered in my earlier articles, the price of integrated tuners is expected by most in the industry to come down considerably and soon, but unfortunately, the 2005/6 lines are not showing a considerable drop yet.

There was an average $704 extra on the 2004/5 lines announced a year ago, and is now in the $500 range on the 2005/6 lines. Samsung announced in 2004 that their integrated versions (Series 67 expected for Apr 05) would be priced $500 above the monitor versions (Series 63 released in Jun 04), and Toshiba showed a mark up of $400 for the integrated tuners on some of their newer models.

On the other hand, as mentioned above, Thomson was able to introduce a 480i SD integrated 27" TV with an ATSC tuner for just $269 MSRP. Granted the integrated tuner outputs only 480i SD for the TV to operate at that resolution, but for the tuner to be DTV compliant it must be able to tune to the 18 ATSC formats. The inclusion of such tuner in a $269 consumer product (that is also a TV) shows that is actually possible, today, to bring down the cost of integration to much lower levels than the $500 average.

Enjoy the report.

H/DTV Implementation Update

Brief Summary of the DTV Plan

The original plan for DTV targeted the ending of analog broadcasting by 2007. The FCC provided each station with one additional 6 MHz channel slot so they can broadcast their current analog channel and the DTV version of it simultaneously during the transition period.

By 2007, or when 85 percent of the nation receives DTV, each broadcaster is expected to return to the FCC one of the two channels lent for the transition. That space on the spectrum would then be available for auction by the FCC.

In 2002, television manufacturers and retailers were asked to adhere to a phased-in schedule that would lead to terrestrial OTA DTV tuners in all television sets by Dec 31, 2006.

The FCC then mandated that all TV sets 13-inches and larger and other products that normally carry TV tuners –such as VCRs, personal video recorders, etc. are to include ATSC terrestrial DTV tuners by July 1, 2007.

Under the five-year phased-in guidelines DTV tuners are to be added to 50 percent of sets measuring 36 inches and larger by July 1, 2004, and 100 percent by July 1, 2005. After that, 50 percent of sets measuring 25 inches to 35 inches are to add DTV tuners by July 1, 2005, and 100 percent by July 1, 2006. The rest are to conform by July 1, 2007.

A cable agreement plan was also approved for phased-in use of two digital interface connectors on new digital cable-ready TVs and/or cable set-top converter boxes, including a) Starting April 1st 2004, IEEE-1394 'FireWire/iLink' connections with Digital Transmission Content Protection (DTCP) for recordable and networkable compressed video streams, and b) By July 1, 2005, the non-recordable DVI/HDMI with High-bandwidth Digital Content Protection (HDCP) connections on digital televisions and cable set-top boxes.

The agreement was made for an integrated <u>one-way only</u> digital cable television tuner. Under this unidirectional agreement, bi-directional features that require a return-path of the cable system, such as video-on-demand (VOD), impulse-pay-per-view, and the use of cable-operator enhanced electronic program guide services, provided by the Cable Operator, would <u>not</u> be available, and a separate STB would be needed for those integrated TVs.

By implementing this interactive version of POD, digital televisions would eventually be able to directly receive interactive digital programs without the need for a digital set-top-box from their local cable provider.

In August 2003, the FCC announced the updated progress in the establishment of the two-way interactive plug-and-play cable interoperability agreement. Under this two-way interoperability agreement, sets with interactive functionality will be labeled “Interactive Digital Cable Ready.”

Digital TV sets capable of displaying one-way programming services, including premium channels, would be labeled 'Digital Cable Ready', and they require smart POD cards that will be supplied by cable TV operators to unlock scrambled channels. The POD card is now called “CableCARD.”

CableCARD

According to the agreement, by July 2004, digital cable operators are to provide a CableCARD to subscribers that request one.

FCC’s Proposal to Accelerate DTV Transition

Federal Communications Commission (FCC) media bureau chief Ken Ferree proposed on April 2004 a plan to turn off the analog TV signals by 2009 switching to DTV. Broadcasters would then return the frequencies they use for the transition. A cable system would have to carry the signal on its analog or digital tier.

If the signal were carried on the cable’s analog tier, cable systems would have to down-convert the broadcasted digital signal so legacy analog sets could display it. Cable customers on the digital tier would receive the broadcasters' digital signals. As digital sets increasingly appear into the market, customers would gradually switch to the digital tier.

Both groups would be counted as part of the digital TV audience targeted as 85% to complete the transition from NTSC to DTV, contributing to a faster DTV implementation.

NAB and the industry declared on that opportunity that the proposal would have a negative effect on the transition and the public would not be motivated to replace existing analog sets. National Cable and Telecommunications Assn. president Robert Sachs did not endorse the plan but was open to further talks.

DTV Summit

On March 2004, the DTV Summit discussed that even though the growth for DTV has remarkable, the deadline of 2007 or 85% penetration could not be met as planned.

The CEA estimated that by then there would only be about 62 million DTV sets/monitors installed with a penetration of 53% of US homes, but with only 33% of homes tuning/displaying DTV signals.

The CEA also said that DTV is being implemented at twice the speed color TV was, considering that in five years DTV reached 1 million market penetration, while it took 10 years for color TV to reach the million mark. Although my statistics indicate that in five years, about 4 million HDTVs were sold and the one million number was actually for HDTV STB tuners, so the speed of penetration is more than twice

considering those numbers, consult the 2003 and 2004 CES reports for more information.

It was mentioned at the summit that broadcasters must be required to supply their signals at full power (two thirds use low power at the time of the Summit), and cable operators should be required to retransmit DTV broadcast the same way they receive it, without affecting resolution.

Proposal for Subsidizing HD-STBs

On July 2004, it was reported that the New America Foundation (NAF) proposed to the Senate in a private meeting for government to subsidize OTA HD-STBs at $50 each (estimated chip of $25) and applying tax credits. The proposal was based on a model implemented in Germany in 2003 to about 6,000 homes in the area of Berlin-Brandenburg.

The expenditure was estimated at $385 million nationwide, including low-income households (income inferior to $40,000) that currently receive TV by antenna.

An scenario covering all US households (about 350 million analog TVs) would cost 4.1 billion dollars, reduced to 3 billion when considering tax credits, etc. which is about 4% of the money expected to be obtained when auctioning the spectrum that broadcasters are planned to return when DTV is fully implemented (about $70 billion).

A variety of alternatives where evaluated:

A) Consider homes that subscribe to cable or satellite for the main TV but tune via an antenna on another pair of TVs (17 million homes), such effort could cost approximately $870 million ($610 million represent low-income households that would be fully subsidized, the rest would be subsidized to 50%);

B) Cover 62.5 million homes (17 million homes above plus half of 90 million homes that receive cable/satellite) would cost approximately 3.1 billion dollars (2.25 billion corresponds to fully subsidizing low-income and half-subsidizing the others);

C) The NAB supported subsidizing all households (82 million), which would cost $4.1 billion (2.9 billion to fully subsidize all low-income for the first set, half for the rest);

D) All households would obtain STBs fully subsidized with tax credits.

The government is considering the establishment of a tax to the stations that do not comply with the DTV transition schedule; the collected money would fund the proposal of subsidized STBs.

Senate Approves Plan to Facilitate DTV Transition

On September 2004, the US Senate agreed to a plan that would provide additional communications airwaves to police, fire and rescue organizations. The spectrum would be obtained from some television broadcasters by the end of 2007.

The agreement was a compromise from a broader proposal submitted by Sen. McCain that would also force all television broadcasters to return the complete analog spectrum by 2009 (which was rejected); Senator Burns opposed due to the possibility of leaving some American households without receiving some local television stations when not having the appropriate digital equipment. The Senate intelligence bill required the approval of the House of Representatives.

Some of the stations impacted by the amendment are Paxson, Univision, Viacom, and Tribune; they are within the 24MHz spectrum in the 700 MHz band that covers channels 63, 64, 68, and 69.

It is included into the compromise one billion dollars of subsidies to help consumers with equipment that would enable them to convert digital signals into analog to been able to view the digital channels, or to help consumers subscribe to cable or satellite to view those digital stations, both with the objective of not forcing consumers to replace their TV sets if they are not able to. The funding from the subsidies originates from the moneys to be obtained from the auctioning of airwaves returned by the broadcast stations when they fully switch from analog to digital.

Meeting the Analog Deadline

The FCC was expected to vote in November on a proposal to require the end of analog broadcasting by the end of 2009, but decided to postpone their vote until next spring at about the same time President Bush requested the Commerce Department to develop a plan to make sure the original deadline of December 31, 2006 is met.

Must-Carry Multicasting Channels

In December 2004, the FCC has confirmed their earlier opposition regarding forcing cable operators to carry any other broadcasted digital multicast sub-channel other than the primary. The issue was brought by some broadcasters (including Paxon) to the United States Court of Appeals for the District of Colombia Circuit because they wanted cable operators to carry all of their multicast channels. A vote was planned for February 10, 2005, before Mr. Powell departs from his post as FCC ‘s chair.

H/DTV Programming

On past CES reports, I dedicated a section to the details on this subject. I believe that now there are sufficient H/DTV channels to motivate adoption based on content not just technology, so I will limit this section to just some highlights.

On September 2004, ESPN announced that HD ESPN 2 would be launched on Jan 05 with 100 live HD telecasts the first year.

On November 2004, NBC Universal Cable renames Bravo HD+ to "Universal HD" and will offer hundreds of HD content from the NBC Universal Library starting December 1, 2004 to a total of 25 million subscribers of DIRECTV, Cablevision, Cox, Insight, Mediacom, Voom, etc.

On December 2004, DirecTV announced their agreement with Fox Television Station Group to carry FOX H/DTV channels in 26 market areas of eligible viewers (where the network has am owned and operated affiliate, 46% of US viewers), including New York, Los Angeles, Chicago, Philadelphia, Boston, Dallas-Fort Worth, Washington, D.C., Atlanta, Detroit, Houston, Tampa, Fla., Minneapolis, Cleveland, Phoenix, Denver, Orlando, Fla., St. Louis, Baltimore, Milwaukee, Kansas City, Mo., Salt Lake City, Birmingham, Ala., Memphis, Tenn. Greensboro, N.C., Austin, Texas and Gainesville, Fla.

Pacific and Mountain subscribers will receive LA 's KTTV, Central and Eastern subscribers will receive New York's WNYW. The service would be free for subscribers of local channels package that live within the market areas above; they need to have HD IRDs.

On January 2005, DirecTV added ABC's network HD feed to their service in 10 markets including Chicago, Flint, Michigan, Fresno, Houston, Los Angeles, New York, Philadelphia, Raleigh, San Francisco, and Toledo. The markets have Local stations that are owned and operated by ABC. East coast subscribers will se the New York feed, West coast subscribers will see the Los Angeles feed. With the addition of FOX and ABC, DirecTV has now all the four networks in HDTV (it already had CBS and NBC), although not all are yet available to certain markets.

On May 2004, DIRECTV stated that it currently offers the national CBS HD feed for customers living in CBS O&O markets, and soon the company expected to add the national NBC HD feed to customers living in NBC O&O markets.

On May 2004, Dish Network added TNT HD East coast feed in channel 9420, to include sports, movies, TNT originals, and shows in 16:9 5.1 DD. Dish Network would then offer five channels within its $10 monthly package (TNT HD, HDNet, HDNet movies, and Discovery HD).

On May 2004, Voom, in addition to the HD channels, 2 HD Showtime, 2 HD HBO, 2 Cinemax HD, 1 Discovery, 2 Starz HD, NFL HD part-time, The Movie Channel HD, etc., announced their plans to add Encore HD, Bravo HD, NBA HD, TNT HD, ESPN HD, Playboy HD, and HD Preview channel. HDNet and INHD will not be included as planned.

Time Warner introduced TNT HD to its Charlotte's NC subscribers starting on May 2004; East coast feed 24/7, in channel 281.

On May 2004, the Outdoor Channel HD announced that it will create new HD content to sell to others like INHD, in 2005 will launch as a 24/7 HD channel.

Market Penetration of H/DTV

The following statistics originate from the official announcements of the Consumer Electronics Association (CEA).

CEA

The organization "Represents more than 1,850 corporate members involved in the design, development, manufacturing, distribution and integration of audio, video, mobile electronics, wireless and landline communications, information technology, home networking, multimedia and accessory products, as well as related services that are sold through consumer channels. Combined, CEA's members account for more than $100 billion in annual sales."

The Growth by the Numbers

On August 2004, the CEA announced that one of every four TVs sold in 2004 would be an HDTV. 2.8 million DTV units (integrated or monitor capable of at least ED 480p) were sent to dealers on the first semester of 2004, equivalent to 2.7 billion dollars of revenue; an increase of 80% compared to 1.5 million sets sold in the same period last year, making the total of DTV sales to 11.7 million sets since their introduction in 1998, most of those sales have occurred over the last two years.

In Sep 04 (CEDIA), upon showing the existing line, Mitsubishi commented "under the FCC mandate half of every manufacturer's big screen TV line had to include digital cable ready tuners this year, 68% of our sales have been with integrated tuners"

On November 2004, the CEA reported 13.3 million DTV sets sold since 1998, about $20 billion of investment. 4.4 million DTV sets were sold between January and September 2004 alone (71% increase compared to same period in 2003), which is about the same total number sold on the complete 4 years period of early adoption of H/DTV (Nov 1998 - Nov 2002). September alone was recorded as close to 750,000 sets sold, a 40% increase compared to September 2003; October sales was reported as 968,000 (1.29 billion dollars), a 136% increase over October 2003 (and a 102% increase in dollars).

Furthermore, the CEA Market Research projected in November 2004 that the total sales for the year 2004 as almost 7 million H/DTV sets. The same report projected sales as 10.8 million in 2005, 16.8 million in 2006, 23.3 million in 2007, and 27 million in 2008.

Trend from the Previous Two Years

To provide a perspective of how the market of H/DTV is growing I include below a couple of projections made over the last two years, together with their corresponding actual sales volume, first, a statistic provided on my CES 2003 report (Jan 2003) two years ago:

"*A projection from the CEA showed that 2.7 million of DTV products would have sold in 2002 alone, 4 million would be sold in 2003, 5.4 million in 2004, 8 million in 2005 and 10.5 million in 2006. There are now approximately 4 million HDTVs sold since 1998. "*

A year later, on my CES 2004 report (Jan 2004), the statistics showed an even better trend:

"In October 03, the CEA reported the year-to-date DTV with an increase in market penetration because of strong sales in the plasma and liquid crystal display (LCD) monitor categories. The year-to-date DTV sales actually reached over 2 million units in the period of January-August 2003, representing $3 billion dollars of DTV investment. DTV unit sales increased by 26 percent in August compared to August 2002, 18 percent in dollar revenues.

Regarding HD-set-top-boxes (HD-STBs) January through August 2003 showed also 148 thousand units sold, an increase of 376 percent in August 2003 compared to the same month in 2002. August 2003 sales alone totaled approximately 26,000 units. The cumulative DTV set-top box sales figure - sales from 1999 through June 2003 – was close to 400,000 units. That brings ATSC-receiving products, including both integrated sets and stand-alone set-top boxes, to over 700,000 units.

From the introduction of DTV until August 2003, DTV product sales totaled about 6,800,000 units, a dollar investment of almost $12 billion. CEA Market Research projections at Oct 2003 updated the estimate of DTV products sales as 4.3 million DTV units will be sold in 2003, 5.8 million in 2004, 8.3 million in 2005, 11.9 million in 2006 and 16.2 million in 2007."

Note that the projection made over a year ago, of 5.8 million for 2004, was still short compared to the actual numbers (4.4 million of actual sales on 75% of the period, or 7 million projected for the full year 2004).

The years 2003 and 2004 were important periods of growth and acceleration of sales, the numbers are indicative that people are more interested in H/DTV, not as early adopters as it happened between 1998-2002 but as TV customers stretching their budget to enjoy better quality TV, rather than just to experiment with the technology as most early adopters do.

By December 2004, the total DTV sets sold since 1998 jumped to 14.3 million, representing about $23 billion dollar sales. Considerable sales are being experienced in flat panel displays, 1.4 million LCD panels would be sold by the end of 2004, 290,000 LCD panels were sold in October alone.

Satellite, Cable, Broadcasting

DIRECTV

On May 2004, DIRECTV named Thomson as principal supplier of their satellite STBs, for at least half of its needs. The agreement was expected to close in 2Q04 provided it meets with regulatory conditions. Under the five-year's supply agreement Thomson would acquire the STB manufacturing assets of Hughes Network Systems, a unit of DirecTV. Thomson would manufacture DirecTV STBs and DVR receivers.

On Sep 2004, DIRECTV announced their plan to launch fourth generation satellites to expand HD and interactive services. The first two new Ka-band satellites, the Spaceway 1 and 2, will be launched in 2Q2005 and programming will be offered by the middle of the year including local HD to most of the US to a capacity of 500 channels, and expanding SD services. The launching will enable the offering of local HD channels initially to 12 markets.

The next two Ka-band satellites DIRECTV 10 and 11 will launch early in 2007 and will expand the capacity to over 1000 additional local HD channels and more than 150 national HD channels, among other offerings to consumers with a single small dish.

DIRECTV also mentioned their plan to implement MPEG-4 AVC in late 2005, and possibly require a new dish capable to receive signals with 5 LNBs. No confirmation was provided regarding how the upgrade path to existing customers will be carried out.

DIRECTV provides satellite services to over 13 million customers, and is 34% owned by Fox Entertainment Group.

On Oct 2004, along the lines of its planned expansion, DIRECTV told the FCC that any dual carriage requirement that would require delivery of both broadcast digital and analog signals would reduce the number of markets that it could provide local TV service, violate the Constitution, and create more burden on DBS than on cable services due to the limited capacity.

In January 2005 DIRECTV further confirmed the satellites launching and HD plan above, and announced new interactive services with mix regular channels with enhanced features such as six channels simultaneous viewing, new DVR's and service, and the introduction of a Home Media Center later in 2005 (although not HD level).

Dish Network

On November 2004, Echo Star Communications praised Congress on passing the Satellite Home Viewer Extension and Reauthorization Act of 2004, which would allow consumers to receive distant HDTV network channels if the local broadcasters do not comply in their timely delivery of their HDTV signal at full power to viewers or if those viewers can not receive OTA from the local affiliates.

On the other hand, the company also expressed disappointment when the bill imposed a 3-year wait period to provide distant network services to viewers; EchoStar declared that it was singled out regarding channel positioning, giving only 1.5 years to resolve the dual dish issue, which now affects the subscribers of 38 of 150 markets that receive the local stations of their area. Dual dish setup is allowed if the local stations are grouped in one dish, or if one dish delivers all the analog channels and the other all the digital channels, but this is not the case of EchoStar. EchoStar has about 10.4 million subscribers.

As part of the approved Act mentioned above, it was also approved that satellite operators would have up to five years the right to offer the four major networks (NY to LA) to subscribers that do not have those channels available via OTA service in their area, or to "sell" that service to those subscribers that want it, even without authorization from the local affiliates.

Regarding future services, Dish Network disclosed in November 2004 that within one year the company plans to start the transition from their current MPEG-2 compression to MPEG-4, which would allow for more channels (regular and HD). When considering the large task for that upgrade the starting could be delayed for later in 2006. The upgrade would require replacement of current MPEG-2 HD-STBs, incompatible with MPEG-4, the new STBs would handle MPEG-4 and decode MPEG-2 signals. The transition could take 4 years to complete, starting with the existing HD subscribers, during that time there will be dual services of MPEG-2 and MPEG-4, and was anticipated that there will be no cost to customers with older boxes.

Dish Network commented at CES 2005 that they have not yet decided how the transition would be done but they anticipate that they might first offer new MPEG-4 capable HD-STBs to HD subscribers that want the newer MPEG-4 channels, then they might offer box replacement to the current HD group of subscribers that are only staying with the current HD channels, and maybe later with the SD customers, if the SD service they receive would also be switched to MPEG-4, an issue that is not yet decided. No additional details were provided of how the transition will be performed or STBs exchanged, but it was already recognized that the upgrade to MPEG-4 could not be done by firmware, card replacement, or user replaceable parts. None of the STBs currently installed support MPEG-4; not even the soon to be introduced (mid 2005) HD-STB DVR supports MPEG-4.

As a comparison, DIRECTV is going thru a similar situation, and Voom current subscribers have STBs that can be upgradeable to MPEG-4 by inserting a new card on the side of the 550 STB, and later be firmware upgradeable with dish downloads.

Voom

As of May 2004, Cable Vision Systems reported 8000 VOOM activated customers (in about six months of operation, launched in October 15, 2003), with quarterly net revenue of $1 million by March 31 2004, generated by the hardware sales.

A number of problems were reported with VOOM Motorola DSR-550 STB, such as DVI problems sending as 480i a 720p signal, no closed caption, no over-the-air channel scanning, no channel delete for mapped channels that are out of reception range, etc. The company was gradually fixing those problems during 2004.

On November 2004, a report was issued by Fulcrum Global Partners showing that VOOM had reached 25,000 subscribers; the goal is to reach 200,000 to start making some profit, at which level each subscriber would be valued as $1,500. The recommendation was to sell or shutter VOOM to stop the losses, a loss that is estimated as $130 million in just the past two quarters. Cable Vision showed their support to VOOM, but also commented on plans to spin off VOOM with Rainbow Media programming assets, although by December Cable Vision decided to suspend the spin off.

On November 2004, Rainbow Media Enterprises announced a large expansion of services by March 2005. The current 39 HD channels will increase to over 70, and add almost 200 SD channels. To that end, VOOM will use 16 transponders on the SES Americom AMC-6 satellite (called Rainbow 2). VOOM will implement Harmonic's MPEG-4 encoding on both satellites (Rainbow 1 already in operation and Rainbow 2) during 2005.

In the long term, VOOM announced their plans to launch 5 Ka-Band high power satellites to increase its channel capacity to over 5000 HD channels in spot beam and half-CONUS beam modes, which would make VOOM able to provide direct broadcast services across the nation.

Approximately 3 years would be needed for Lockheed Martin to manufacture and launch the first of those satellites (estimated life of 15 years), which will be positioned at 62, 71, 77, 119, and 129 degrees. According to VOOM, all the subscribers already have on their STB the capability to decode MPEG-4, and the company is committed to supply over 400 channels by the end of 2005.

On January 2005, the company decided to spin off VOOM and either close or sell VOOM. Later, Dish Network bought VOOM with Cablevision's Rainbow 1 satellite, the ground facilities, and certain other assets for $200 Million.

The acquisition of the Rainbow 1 satellite at 61.5 degrees includes the rights to 11 DBS frequencies of 13, 12 can be operated in "spot beam" mode. How this would affect the expansion plans, MPEG-4 upgrades, the subscribers, and the awaited 580 DVR server/network remains to be seen. Dish Network was going in the same upgrade direction, with the difference that VOOM STBs were already MPEG-4 upgradeable with the satellite card for MPEG-4 and future firmware upgrades.

Cable

On September 2004, the National Cable & Telecommunications Association (NCTA) declared that there are now 177 markets (out of 210) where consumers can receive HD services, 100 of them are Designated Market Areas. There are now 454 local digital broadcast stations carried by cable systems (from 304 in December 2003). 90 million TV households (out of the 108) can be served with HD packages, 28% increase over the 70 million of December 2003.

Almost 2 years ago, Samsung announced at CES 2003 that they were the first company to make an agreement with CableLabs for a two–way bi-directional Cable-CARD tuner implementation. No products were released yet with such capability. Most recently in November 2004 CableLabs announced, again, that Samsung was the

first consumer electronics manufacturer to sign a license for bi-directional Cable Card product capability to implement Cable Lab's Open Cable Application Platform (OCAP) middleware on their DTVs and HD-STBs, which would enable them to have IPG and VOD premium services.

For over the last two years, QAM CableCARD tuners are only unidirectional, lacking the interactive ability for VOD, impulse PPV, and cable-provided EPG.

However, on January 2005, Samsung made an agreement with three MSOs that serve over 20 million subscribers, Time Warner Cable, Brighthouse Cable, and Charter Cable. Under the terms, there will be an implementation of bi-directional OCAP software on Cable tuners, with a middle-ware specification designed with a universal interface. OCAP is part of an industry agreement that is now two years old and was formally known as PHILA (POD Host Interface Licensing Agreement). Later, with the arrival of the CableCARD concept, the name was changed to CHILA (the front "C' from CableCARD).

The National Cable & Telecommunications Association declared on November 2004 their concern with the large troubleshooting effort that is being made to repair integrated plug-and-play HDTVs as follows: "Armies of cable engineering personnel, from field technicians to corporate engineers, have continued to spend time at consumer homes". Reportedly, the problems arise when the card is installed on weak connector pins that are bent due to a soldering-temperature error.

The NAB protested to the FCC for the ban imposed on the deployment of HD-STBs if not having CableCARD after July 2006. The ban is intended to reduce manufacturing costs with the higher demand and availability of a larger number of compliant STBs, when requiring that cable companies use CableCARDs in their own STBs. In a recent report of December 2004, it was disclosed that approximately 10,000 CableCARDs were deployed in over 140 devices from 11 manufacturers, although those have only CableCARD unidirectional capabilities.

The FCC is "monitoring and encouraging" the negotiations and progress made on the bi-directional digital cable services, the talks were held in closed doors and no dateline has been issued yet, the group that participates on those negotiations now has grown to about 90 interested parties, including the MPAA, NAB, and computer companies for hardware and software, which makes the agreements more complicated and slower to be reached.

Broadcasting

At NAB (April 04) Dolby Digital Plus (DD+) was announced for broadcasters to transmit 5.1 at 50% (192kBs) data rate of regular DD (384kBs). There will be a need to address backward compatibility issues with consumer's existing equipment, one idea was to make available conversion devices from DD+ to DD to permit consumer equipment to read as DD.

Edward Fritts, president of the National Association of broadcasters (NAB) declared (Oct 2004) that OTA broadcasting needs to be protected for emergency information to reach consumers, as follows "There are 73 million television sets in use in America connected neither to cable nor satellite, 45 million of which are in homes that rely exclusively on local, 'over-the-air' stations as their sole source of

television," Fritts added in his letter: "These stations provide more than just entertainment; as hurricane-ravaged Florida residents can attest, they provide lifesaving information to communities in crisis".

By August 2004, the FCC reported that has already approved 13 different "digital output technologies and recording methods" to implement the Broadcast Flag order. A complete detail of the subject of Broadcast Flag was provided in the CES 2004 report and in an article I wrote for the HDTVetc magazine (issue # 6) about content protection of H/DTV in general. A summary of what is the Broadcast Flag and a description of the approved technologies is included on the section of Content Protection towards the end of this 2005 report.

The ATSC approved on November 10 a new ATSC standard A76 "Programming Metadata Communication Protocol" known as PMCP, to help broadcasters generate PSIP. On December 2004, it was reported that the FCC has ordered all US terrestrial DTV stations to include PSIP in their broadcasts with a deadline of February 1, 2005.

According to the National Association of Broadcasters, by December 2004, 1356 DTV stations were on air in 211 markets serving 99.95 percent of US households. About 90% of 106 million households are in markets where 5 or more DTV stations are available, and 71% with 8 or more stations.

As of January 2005, 1676 stations (97%) have been granted a DTV construction permit or license, 1481 stations are already in the air with DTV broadcasting.

USDTV

On April 20, 04 the USDTV subscription service for H/DTV multi-channel broadcast thru a VHF/UHF regular antenna was announced; consumers would purchase a USDTV-Ready STB (sold a Wal-Mart stores and some electronic chains) to tune to 12 popular cable channels in addition to OTA H/DTV channels. Wegener Unity 4600 receivers will be located at USDTV broadcast stations, which receive the satellite USDTV channels and broadcast the content to terrestrial signal subscribers

On July 2004, USDTV announced a partnership with LG to suit their USDTV STBs with 5th generation 8-VSB and ATSC tuners, which would be benefited by the ability of the chip to enhance OTA reception in difficult areas. The USDTV service operates from Salt Lake City, Albuquerque, and Las Vegas, and costs less than $20 per month. The service offers OTA SD and HD of popular networks, by using spectrum that some partners do not use.

On my visit to their booth at CES, I had the opportunity to discuss about their service and hardware. The company indicated that in order to have enough bandwidth for their services they take any unused pieces of other channel's bandwidth to find room for what they need broadcast.

USDTV offers several options for their services as follows: a) a $20 initiation fee and $ 20 monthly x 12 months, the subscriber would have own the box at the end of the period, b) $20 x month plus $200 purchased box, or c) $200 purchased box with no service, but with the box a customer would be able to tune to ATSC HD

over the air programming, relatively cheap considering the cost of the other ATSC tuner HD STBs that usually carry a minimum $350 MSRP. One thing that should be noted is the absence of IEEE1394 outputs on their HD-STB, meaning there is no D-VHS HD recording possible from what the box tunes, a feature that all of the other OTA HD-STBs have. It was discussed the possibility of future features, like a DVR, among others plans, but no details were provided to be disclosed as press announcements.

Analysis of H/DTV Equipment

Panel technology and microchip-based displays have taken a larger position in the HDTV market. It was remarkable the price reduction experienced on LCD and Plasma panels compared to the year before. DLP and LCD are the main technologies now used for RPTVs, although CRT is not yet withdrawing from the market.

Many major companies introduced new lines of RPTV and Direct-view models based on CRT technology, which continues to offer the best value for a good quality display known for its excellent rendition of black, provided space and weight are not a constraint. Additionally, with the new introduction of slim tubes using 33% less depth, direct-view sets might create a shift on the market share for second/third room applications, where small LCD panels were starting to be adopted in 2003/4.

The LCoS technology is showing some successes but also some disappointments. There is a parallel effect of companies switching in and out of the LCoS technology depending of the manufacturer, or chip-company. Some justified by the difficulty of manufacturing the chips, some for the limited availability of them, some due to company direction.

For example, Intel announced at CES 2004 their entry to the LCoS chip manufacturing, then they announced in August a delay in the delivery of LCoS chips for projection TVs, the chip could not be made available by the end of 2004 as planned; but later, the company announced the cancellation of the overall effort. Its competitor, Advanced Micro Devices Inc., is still on course manufacturing chips as planned. The LCoS versions of Sony (SXRD) and JVC (D-ILA) chips and HDTVs continue firm with the technology, while other companies such as Sears became interested in LCoS and introduced at least one set, although it is uncertain if the product would actually be released as planned.

LCD panels are becoming larger and larger from one year to another; last year's 40-inch screens introduction seemed a big step forward, a step into the domain of plasmas; this year the competition for even larger panels is heating up. The plasmas and LCD panels announced at CES 2005 overlap in the 37 to mid-50-inches range; the new large LCD TV panels generally cost more than similar size plasmas, twice as much in many cases, but prices are coming down fast for both types of panels.

The larger LCD TV panels are now at 1920x1080 resolution on the 45+ sizes, while in plasmas the 1080p resolution is seen on much larger sizes. One example of LCD TV panel is the Sharp's 1080p 45" LCD TV panel (AQUOS models 45GD4U and 45GD6U) available since fall of 2004 at an original price of $10,000 MSRP (but seen at $8000 range on the street); other panels in the range of 55, 57, and 65 inches were announced at CES by several manufacturers.

Some DLP lines of front projectors that were typically in the range of $10,000 to $13,000 over the last 3 years (such as the FPTV competition of Yamaha, Sharp, Marantz, etc) are being replaced by updated models but at about the same price range. New features and better technology and chips on the new models seem to justify upholding of the price range.

A similar effect has been noticed with some companies that are introducing new models at a about the same prices than the sets they replace, if not higher. The new sets are suited with newer or better features or chips (such as HD2, HD3, HD2+ TI's DMD chips), or/and add mandated built-in ATSC/QAM cable tuners, which generally increases the TV price between $400-$1000. Tuner integration is starting to show some signs of cost reduction, manufacturers that charged an extra $700 for the integrated HD tuner on their 2003/4 models, are now charging $500 for their 2005/6 models and in some cases even less.

CES 2005 showed a larger volume of integrated sets to meet the FCC mandate and deadlines. However, there are still at least two issues to be resolved: a) the cost of integration and HD-STBs is still too high, and b) integrated QAM CableCARD tuners are being implemented with only unidirectional limited functionality. Unfortunately, when having the tuner inside the HDTV, physical tuner upgrades/replacements would not be as easy as a STB. However, if they were designed properly, they should be able to receive firmware upgrades downloaded from the service provider, as STBs do.

The integration extra cost was expected to come down, and is gradually happening, but as indicated above is not yet to the level it should be. Consumers purchasing a HDTV might not be aware of the actual cost of integration they are subjected to endure. Soon, there will not be monitor-only versions to facilitate some comparisons, such as lower-cost monitors compared against identical integrated versions. Subscribers of satellite services would have no option than to pay for an integrated set with tuners he/she would not need. All those issues still exist throughout the last few years.

Regarding the issue of QAM Cable CARD with only unidirectional features, the recently announced 2005/6 models, and most probably the not yet announced 2006 models from some companies, will not come with bi-directional features. Samsung seems as the only company that made an agreement for bi-directional features (recently with CableLabs), but their 2005 models were announced as only unidirectional.

In other words, consumers might need to wait for at least another year or two before seeing bidirectional features in future QAM Cable CARD integrated HDTVs, which makes for a total waiting of 3 to 4 years from the initial cable plug-and-play agreement approved by the FCC, if not more.

The consequence of such waiting is that many more millions of integrated TVs would be sold over the next two years suited with just unidirectional features, probably in the range of 30+ million judging by the trend of sales (in 2004 alone the yearly sales jumped to 7 million sets from 3 million in 2003). The cumulative total of QAM CableCARD integrated sets sold by the end of 2006 could be close to 40 million sets.

Unfortunately, the FCC approved plug-and-play agreement has stretched its plan for unidirectional-soon-to-be-bidirectional longer than expected. Many of those 30+ million consumers will be footing the cost of an early replacement of an otherwise good integrated HDTV w/unidirectional QAM Cable tuner, to get a bi-directional version, or by having to lease the duplicated Cable HD-STBs for the bi-directional services. Perhaps you might be one of those consumers.

CES showed a large adoption of DVI and HDMI connections in HDTV displays, HD-STBs, and DVD players with upconversion to HD. Such connection is for the transmission of protected digital HD uncompressed video. HDMI will provide also multi-channel digital audio over the same cable. Check the Digital Connectivity section for details on this area, the industry is moving consistently in that direction.

The support for IEE1394 on integrated tuner equipment has increased. Such feature allows for HD networking and external HD recording to DVRs and D-VHS. Make sure the integrated set you want has 'activated' IEEE-1394 two-way connections. Even when present, they might only work with the manufacturer's proprietary implementation of it, incompatible to other brands and models, such as the case of the Toshiba's new stand-alone DVR (Symbio) designed to work only when paired to certain new Toshiba's integrated TVs. Check the HD-DVRs sections.

New products are beginning to show support for the Broadcast Flag content protection, as mandated by the FCC. There is a section at the end of the report that covers that subject, or read my article regarding DTV content protection regulations, on issue # 4 of the HDTVetc magazine.

When looking at the following listings of equipment, remember that the date that appears a head of each grouping (like Oct 04) indicates product announcement/introduction, and provides a perspective of the maturity of a product that facilitates comparisons within the same manufacturer, or other manufacturers. The date also helps anticipate that new products could be announced shortly in 2005, following the manufacturer's annual cycle, when out of the CES timing. A good number of manufacturer groupings will also have a CES 2005 subheading usually located towards the end of each group to include all the information announced/disclosed at CES 2005.

Regarding acronyms and terms, I include at the end of the report a Glossary of Terms related to H/DTV and Home Theater technology. I use the term TTM to indicate Time To Market (product reaching the stores); TBA as To Be Announced (used for time or price); '1394' or 'IEEE1394' (FireWire connection) interchangeably; 'CR' for Contrast Ratio (check the glossary for the definition); and 'component' for component video inputs/outputs to carry HD analog signals between pieces of HD equipment, mostly known as 3-wire YPbPr but could be VGA RGB or BNC.

CRT, LCoS, D-ILA, SXRD, SED, and LCD

Note: DLP, LCD-TV and PDP Plasma panels are not included in this section

Akai
CES 2005
CRT RPTVs Integrated
TTM Apr 05, HD component, ATSC tuner but no cable tuner
42'" PT421QHD $1000
47" PT471QHD $1100
52" PT521QHD $1200

Barco
Oct 04
LCD FPTV
IConH600 1920x1080

Brillian
CES 2005
65" BR6580 1080p UltraContrast Gen II LCoS, 2000:1 CR, offered also in 720p, DVI, VGA, HD component, upgradeable software

Bravo 3M
LCD FPTV
S10 LCD projector, pedestal design, 1200 ANSI, whisper mode, 2000 hour lamp life, vertical keystone correction, built-in speaker.

Canon
LCD FPTVs
LV-S3 SVGA (800x600), 4.9 lbs, silent mode 32dB, 1250 ANSI lumens, 1.2X Canon Optical Zoom lens for up to 100" screen from 10.4 feet, ideal for small spaces, progressive scan conversion.

Oct 04
LCoS FPTV
LCoS projector (Aspectual Illumination System – AISYS)
Realis SX50 $4000, TTM Nov 04, 1400x1050 SXGA, 2500 ANSI lumens, 1000:1 CR, 8.6 pounds, 1.7 optical zoom lens, 100-inch image from 9.8 feet away, converts 480/575 to 1050 progressive, DVI/HDCP, component, VGA for PC connectivity.

Dec 04
LCD FPTVs
LV-7565 $8000, TTM Nov 04, 5100 ANSI, 1000:1 CR, LV-NI01 Network Imager
LV-7565F $7500, TTM Nov 04, same as above without 1.3x zoom lens

Crystal View

Dec 04
FPTV
CV-1 9-inch CRTs

Daewoo
Apr 04
CRT RPTVs
NTSC tuner, TTM Apr 04, 400:1 CR, 1080i, 600 cd/m2, 5 band-equalizer
47" DSJ-4710CRA $1300
55" DSJ-5510CRA $1600

LCD RPTVs monitors
Two piece cabinets, 720p, 5-band equalizer
50" DJS-5020LN $4000, TTM 3Q04
60" DSJ-6000LN $4500, TTM current

Epson
CES 2005
LCD RPTVs
Living Station line
Similar specs than previous P1 line but now integrated
ATSC/NTSC (no cable) tuners, 1280x720, DVI, component, RGB
47" LS47P2 $2900
57" LS57P2 $3400
Check complete details of the P1 line in 2004 report

57" 1080p prototype version, $4000 estimate, TTM 2006, will be released in a different size than the 57" shown as prototype

FPTVs
Powerlite line
Cinema 200+ succeeds 200, 1280x720, 1500 lumens (from 1300), 1000: 1 CR (from 800:1), no DIV or HDMI, RGB VGA, YPbPr, D$ for Japan, USB
Cinema 500 continues from last year, check details on 2004 report
Home 10+ succeeds 10, 800:1 CR (from 700), 1200 lumens, 854x480

Faroudja
May 04
D-ILA FPTVs
Anamorphic lenses, and DVI inputs, paired with either DVP1010 or DVP1050 ($10000) digital video processors
FDP-DILA3 3x0.7 inch chips, 1400x1050 at 800 lumens output
FDP-DILA2 3x0.9 inch chips, 1365x1024 at 100 lumens output

CES 2005
D-ILA FPTVs
FDP-DILA4 3 chips 1400x788, 2.1 to 2.6 manual zoom, multi-scan up to 120KHz, DVP1010 or DVP1510 processor option, with DVI/HDCP, YPbPr, RGB BNC or DB15 on video processor, DCDi

DILA-1080pHD $40000, 3 chips 1920x1080, 1.8 to 2.35 manual zoom, 2000:1 CR, DVI/HDCP, option of DVP1080 ($6500 TTM Feb 05) or DVP1510 digital video processors, DCDi

Fujitsu
Nov 04
LCD FPTV
LPF-D711 $25000, 1080p, three 1.3-inches 16x9 LCDs, Epson's technology, Advanced Video Movement II (AVM-II) digital video processor, selector unit LPF-QSD1WB with HDMI, DVI-D, component, digital and analog RGB, RS-232, 3300:1 CR, 1200 ANSI lumens, images from 36 inches to 25 feet diagonally, 3 year warranty on projector, 2000 hour warranty on bulb

Hitachi
Apr 04
LCD RPTV line
Virtual HD 1080p video processor, DVI, 26 point video processing, automatic 1080i 3:2 film correction, PCMCIA slot for photo memory card, TTM Apr 04
60" 60V500 $4500
50" 50V500 $3800

Jun 04 (company announcement of 2004/5 models)

Hitachi concentrated its DTV efforts in LCD (RPTV and direct-view) and CRT RPTV for 2004/5 models, which includes the new "CineForm" design series of fully integrated/CableCARD sets, expected by year-end 2004. The company has switched from 3 to 21 integrated models transitioning to CableCARD tuner integration, using Hitachi's VirtualHD 1080p upconversion video processing on all models.

Eleven new Ultravision CineForm models (below)
All integrated with ATSC/QAM CableCARD/dual NTSC tuners, Virtual HD 1080p video processor, identical vertical/horizontal look within the line, reduced height, two stage light engine, new dual-focus, advertising to start in Sep 04

LCD RPTVs Integrated

Ultravision VS810 Series
For open distribution, two HDMI/HDCP, 40 watt speaker system
50" 50VS810 $4000, TTM 3Q04
60" 60VS810 $4700, TTM 3Q04
70" 70VS810 $7000, TTM 4Q04
Ultravision Director's VX915 Series
For A/V retail stores, adds to above dual two-way 1394/DTCP, high-gloss cabinet w/black trim, deep-black anti-reflective shield, learning A/V Net III remote, TTM 4Q04
50" 50VX915 $4700
60" 60VX915 $5500
70" 70VX915 $7500

Non-CineForm LCD Integrated RPTV
Fully integrated ATSC/QAM digital CableCARD tuning capability, TTM 3Q04
V710 (entry) Line
720p, Virtual HD 1080p processing, HDMI, USB, 40watt 3-way speaker system
42" 42V710 $2800
50" 50V710 $3300
60" 60V710 $4000
V715 (step-up) Line
Titanium silver finish
50" 50V715 $3300
60" 60V715 $4000

CRT RPTVs
Series F510 Monitor Line
TTM 3Q04, HDMI, Virtual HD 1080p processing, 1080i/540p
46" 46F510 $1500
51" 51F510 $1700
57" 57F510 $2000
Series F710 Integrated
TTM 3Q04, adds to above integrated w/ATSC and QAM CableCARD tuners
65" 65F710 $3000
Series S715 Ultravision Integrated Line
TTM 3Q04, adds to above five element lens system, USB, 40 watt speaker system
51" 51S715 $2200
57" 57S715 $2500

LCD FPTV Ultra-vision
PJTX100 $4000, TTM 2Q04, 16:9 LCD for screen sizes between 30" and 300", 1200 ANSI, 1200:1 CR, 1280X720, 1.6:1 zoom, horizontal/vertical lens shift, DVI/HDCP

InFocus
Sep 04
LCD FPTV
ScreenPlay 5000, 3-chip, $2000, 1280x720, DVI/HDCP, component

LCD RPTV

ScreenPlay, ultra-thin cabinet under 7 inches, dual integrated HDTV tuners, uni-directional Cable CARD, HDMI/HDCP, IEEE1394

50”	SP50rp10	$8000
61”	SP61rp10	$10000
70”		TTM early 2005

JVC

D-ILA FPTVs

SX-21

HX-1

DLA-QX-1 (QXGA) 2048x1536, 7000 ANSI lumens, CR > 1000:1, 1080i/24p/fp input capability, 12-bit gamma, 10-bit color processing, horizontal/vertical lens shift, optional anamorphic lens system, interchangeable lens system, HD-SDI input, DVI-D dual link option w/HDCP, for digital cinema screens <30 feet, home theater screens 12-20 feet, telecine transfer labs, YPbPr, RGBHV VGA, supports vertical Sync frequencies of 48Hz – 120 Hz (1080p/24/30/60i) and horizontal 31kHz –135kHz

DLA-HX2U 1400x788, 1500:1 CR, DIST, professional product

HD-2K, three D-ILA devices, 1920x1080 advanced technology, 2000:1 CR, 2-piece design, lower cost longer life lamp than Sony SXRD (one tenth), 13 element projection lens, outboard Faroudja 1080p signal processor via DVI-D, 13 pounds, TTM Summer 04

HD-4K projector comparable to 35mm quality, 4096x2160, 8.8 million pixels, 100000 hours lifetime in display modulators.

D-ILA RPTV line

TTM Oct 04, integrated w/QAM CableCARD, and 1394 ports.

52”	HD-52Z795	$5000
61”	HD-61Z795	$

CES 2005

D-ILA 720p RPTV integrated line

ATSC/QAM Cable CARD tuners, dual IEEE1394 ports

52” 56” and 61” are offered in black or silver cabinet option as line 786

52”	HD-52G886	$3300, TTM Jun 05
56”	HD-56G886	$3700, TTM Jul 05
61”	HD-61Z886	$4000, TTM Mar 05
70”	HD-70G886	$7000, TTM Mar 05, black cabinet cosmetic, memory card

A 70” RPTV was introduced as a D-ILA 1920x1080p integrated set; the picture was one of the best of the show:

D-ILA 1080p RPTV integrated line

ATSC/QAM Cable CARD tuners, dual IEEE1394 inputs, dual HDMI inputs, no DVI

61”	HD61FH96	$6000, TTM Sep 05
70”	HD70FH96	$9000, TTM Sep 05, memory card slot

JVC DILA 70" 1080p RPTV HD70FH96

LG

CES 2005

LCoS RPTV line

XG engine, integrated ATSC/NTSC/QAM Cable CARD tuners, 1920x1080p, $TBA, HDMI/HDCP, IEEE1394, 3500:1 CR,

62" 62SL1D $TBA, TTM TBA

71" 71SL1D $TBA, TTM Jul 05

CRT super-thin direct-view

30" integrated ATSC/NTSC tuners, 1920x1080i native resolution, HDMI/HDCP, HD component input

3-D RPTVs

LG displayed an interesting pair of 60-inches RPTVs showing 3-D images using a Stereoscopic Projection System of video games. For proper viewing, it was necessary to wear the typical 3-D glasses. The pair of display RPTVs were mainly to make a technology statement, but it also might become a near future product line of LG if the market demands it. According to LG, the system is applicable to 3D Game, 3D CAD, 3D Simulator, etc. at an optimum 3D view distance of 2.5 m (but more than 1m) using inputs as Normal DirecX-Based 3D Games and 3D Video.

Mitsubishi

April 2004 (company announcement of 2004/5 models)

LCoS RPTV

82" Alpha 925 $21000, TTM Oct 04, 1920x1080 pixels resolution, 120GB DVR for 12 hours HD, 72 hours SD, MPEG SD encoder, diffusion screen, two-way speakers, this new unit has now an internal DVR, but still costing $21000 as last year's model Alpha WL-82913

Diamond Series LCD Integrated TVs

ATSC/NTSC/QAM CableCARD tuners, IEEE-1394, HDMI/HDCP, 120GB HDD DVR for 12 hours HD, 72 hours SD, TV Guide Onscreen IPG, MPEG SD encoders, Net Command 4.0

42” LT-4260 $14000, 768x1365, TTM Oct 04, uses 20 fluorescent lamps
55” LT-5560 $TBA, 1080x1920, TTM TBA, uses 28 fluorescent lamps

CRT RPTVs
315 Series, upgradeable monitors, DVI/HDCP
42” WT-42315 $1600, TTM Apr 04
48” WS-48315 $1800, TTM May 04
55” WS-55315 $2200, TTM Mar 04
65” WS-65315 $2700, TTM Apr 04

Eight CRT RPTV Fully Integrated Models
ATSC/QAM CableCARD tuners, AMVP2 processing, IEEE-1394, Net-Command 4.0 system control, HDMI/HDCP
515 Series
48” WS-48515 $2300, TTM Jul 04
55” WS-55515 $2700, TTM Jul 04
65” WS-65515 $3200, TTM Apr 04

Medallion 615 Series, TTM Aug 04
55” WS-55615 $3000
65” WS-65615 $3500
73” WS-73615 $5300
Diamond 815 Series, TTM Aug 04

55” WS-55815 $4500
65” WS-65815 $5500, 9-inch CRTs

Moxell
CES 2005
First line of direct-view CRT TVs (ten)
Proview CRT
13”, 20”, 24”, and 27” analog models from $90 to $400 in Mar/Apr 05
27” TI-627 $450, TTM May 05, HDTV monitor
30” TI-630 $650, TTM Jun 05, HDTV monitor
32” TI-632 $700, TTM Jul 05, HDTV monitor

Panasonic
2004 lines (D64 and 54 RPTVs, L14 and LCX64 LCD RPTVs) are still current; check details and original MSRP prices on the CES 2004 report

LCD FPTV
PT-AE500, 1280x720 LCD panels, 10 bit digital processing and gamma correction, three layer RGB structure for 2.76 million pixels, 850 ANSI lumens, 1300:1 CR, 100" screen size from 10 feet distance.

Oct 04 (announced at CEATEC)
LCD FPTV
PT-AE7000U-EC $3000, TTM Oct 04, 2000:1 CR, 2x optical lens, 1000 lumens, 480i/p, 720p, 1080i, 10-bit gamma correction, Smooth Screen Technology for film appearance

Nov 04
Panasonic confirmed their decision to discontinue CRT RPTV production by March 2005, although direct-view continues.

CES 2005
LCD RPTVs
Integrated with ATSC/NTSC/QAM Cable CARD tuners, Photo Viewer w/SD slot, RGB PC input, HDMI/HDCP
LCX85 Series
61" PT-61LCX85 1080p, 2000:1 CR

LCX65 Series
44" PT-44LCX65
52" PT-52LCX65
61" PT-61LCX65

Philips
Jun 04
LCoS RPTVs
New 3rd generation, Matchline and Epic series in 55" and 62" sizes.
Matchline
55" 55PL9774 $4300, TTM current
62" 62PL9774 $N/A, TTM Jun 04
Epic line
55" 55PL9524 $3800, TTM current
62" 62PL9524 $4200, TTM Jun 04

Oct 04
Cineos series
Integrated CableCARD/ATSC tuners
44" 44PL9523 $2300, black and black/silver cabinets
55" 55PL9223 $2500
55" 55PL9524 $3000
55" 55PL9774 $3000
62" 62PL9524 $3300
62" 62PL9774 $3500

On Oct 04, Philips announced that it has decided to discontinue their LCoS business with engines and RPTV, the company indicated that it had invested approximately $200 million in LCoS, the RPTV market was too small, and is not willing to increase the investment for the company to compete with these products. Operations were planned to stop on November 19, 2004. The company also announced a retail price reduction of $500 on existing LCoS sets.

CRT RPTVs
Three models:
51" 51pp9920 $2100
55" 55pp9920 $2300
60" 60pp9920 $2600

Runco
FPTVs
Vision Line
Model 60 $15000, 1400x768, D-ILA
Model 100 $25000, 1366x768, LCD, 70 foot-lamberts

Sep 04 (CEDIA introduction)
Cinewide motorized anamorphic lens for 2.35:1 aspect ratio, the technology expands 1.78:1 to 2.35:1

Samsung
Jun 2004 (company announcement of 2004/5 models)

CRT RPTVs Monitors
TTM Apr 04, HDMI/HDCP, two component inputs
42" HC-P4252W $1200, tabletop

47” HC-P4752W $1300, tabletop
52” HC-P5252W $1500, floor-standing

A year ago at CES 2004, Samsung announced that it would drop the 55” and 65” CRT RPTV monitor sets to focus on micro-display technologies, and actually happened in 2004. The company also indicated that it plans to transition the above CRT RPTV monitors to fully integrated CableCARD sets later in the year, a difficult endeavor when adding a relatively expensive HD tuner to the low cost of CRT models, according to Samsung. One integrated (transitioned) model mentioned at CES 2004 was:

52” HC-P5256W $2,200, TTM later 04, integrated w/ATSC/QAM CableCARD, DNIe, HDMI (note the estimated difference of $700 of the MSRP of 52” monitor vs. the estimated integrated at CES 2004 time).

CRT Direct-view Integrated Models (eight)
Built-in ATSC tuners in four screen sizes, in-the-clear QAM digital cable tuner (omit CableCARD), DynaFlat picture tube, DVI/HDCP, accept 1080i/720p to display as native 1080i
30” in 16x9 AR, three models priced between $1000-$1200
26” in 16x9 AR, two models priced at $700 each
32” in 4x3 AR, two models at $1000 each
27” in 4x3 AR, $700

CES 2005
Samsung has shown a new technology to reduce by 30% the depth of a direct-view CRT tube. The technology is called “SlimFit” and will be used on a new line of sets:

DynaFlat SlimFit CRT direct-view TV Series 30” TX-R3079WH $1300, TTM Mar 05, 15.5 inches deep, integrated ATSC tuner, HDMI, 2 HD/DVD component inputs

CRT RPTVs new line
TTM 2Q05, floating screen cabinet, integrated ATSC tuner, excludes QAM Cable CARD slot
43” $1300
47”

Sanyo
Oct 04
LCD FPTV
PLV-HD10 1920x1080, 5500 ANSI lumens, 1000:1 CR

Sanyo PLV-HD10 FPTV

PLV-WF10 1366x768, 3000 ANSI lumens, 900:1 CR

LCD RPTV
Oct 04 (CEATEC introduction)
55" LP-55WR1 $6000, TTM in Japan Dec 04, in US by 2005, 1280x720

LCD FPTV
Oct 04 (CEATEC introduction)
LP-23 $3100, TTM Oct 04 in Japan, 2000:1 CR, 1280x720, up to 200 inches image

CES 2005
LCD FPTVs

PLC-EF60	1400x1050, 5800 ANSI lumens, 1300: 1 CR
PLC-XF60	1024x768, 6500 ANSI lumens, 1300:1 CR
PLC-XP56/L	1024x768, 5000 ANSI lumens, 1200:1 CR
PLC-XP51/L	1024x768, 4000 ANSI lumens, 1000:1 CR
PLC-XU51	1024x768, 2000 ANSI lumens, 450:1 CR, ultra portable
PLC-XU56	1024x768, 2500 ANSI lumens, 450:1 CR, ultra portable
PLC-XU47	1024x768, 2000 ANSI lumens, 450:1 CR, ultra portable
PLC-XU41	1024x768, 1500 ANSI lumens, 450:1 CR, ultra portable
PLC-SU51	800x600, 2000 ANSI lumens, 450:1 CR, ultra portable
PLC-SW35	800x600, 1500 ANSI lumens, 350:1 CR, ultra portable

Sears
Sep 04
First LCoS own brand (Veos)
65" 720p monitor, Brillian chip, $8000, 2000:1 CR, DVI, optional expansion port for ATSC tuner, QAM cable tuner w/Cable CARD, and 1394 memory card devices

Sony
February/June/August 2004 (company announcements of 2004/5 models)

On February 2004, Sony introduced twelve HDTV integrated models with ATSC/NTSC/QAM CableCARD unidirectional tuners with HDMI/HDCP digital connectivity and two HD-STBs with DVR for QAM Cable CARD tuning. Of the twelve models, six are LCD Grand Wega RPTVs, four CRT Direct-View sets, and two CRT-based RPTV sets, as follows:

LCD Grand Wega Integrated RPTVs

Two new series (WF and XS) were added to the entry-level (WE) and high-end (XBR) Series, and two new models were added within the WE Series, TTM Sep 04, 16:9 AR, Sony LCD Optical Engine video processing

New models on the WE Series

42"	KDF-42WE655	$2800
50"	KDF-50WE655	$3000

New WF Series

55"	KDF-55WF655	$3700
60"	KDF-60WF655	$4000

New XS Series

55"	KDF-55XS955	$4000
60"	KDF-60XS955	$4400

Direct-View Integrated CRT Tubes

Trinitron Wega tubes, SuperFine Pitch CRT technology, Wega engine processing

34"	KD-34XBR960	$2200, TTM Jun 04
34"	KD-34SX955	$2000, TTM Aug 04
36"	KD-36SX955	$1900, 4:3 AR, TTM Oct 04
30"	KD-30SX955	$1400, 16:9 AR, TTM Aug 04

CRT-based RPTVs Integrated

TTM Sep 04, WEGA engine, Direct Digital, DRCM (Digital Reality Creation MultiFunction), Multi-Image Driver (MID-X) circuitry

51"	KDP-51WS655	$2100
57"	KDP-57WS655	$2400

Hi-Scan Series FD Trinitron WEGA Monitors

Solid silver tone, rounded corner cabinetry, dual component inputs, HDMI/HDCP

27"	KV-27HS420	$750
30"	KV-30HS420	$1000
32"	KV-32HS420	$1000, 4:3 AR
34"	KV-34HS420	$N/A, 16:9 AR
36"	KV-36HS420	$N/A

LCoS RPTV (Sony's SXRD Technology)

To pair their current QUALIA FPTV projector, Sony unveiled a 16:9 model KDS-70Q006 for $13000 (previously called KDS-70XBR100 within the XBR line, for $10000), native resolution of 1920x1080, 70 inches, NTSC/ATSC/QAM CableCARD tuners, 200-watt cooled lamp for 3000:1 CR, WEGA Engine System, HD component inputs, HDMI/HDCP, IEEE1394 (iLink), TTM Jan 05.

At CES 2005 the model above was shown with identical characteristics than the XBR set at CEDIA, the set was introduced now as part of the QUALIA hi-end line, and its price increased to $13,000. The TV does NOT accept 1080p externally.

SONY 70" SXRD LCoS 1080p RPTV KDS-70Q006

LCD FPTVs
Superlite line
VPL-ES1, SVGA, 1000 ANSI, $1,300, HDTV capability
Oct 04
Cineza VPL-HS51 $3500, TTM Oct 04, 1280x720, 6000:1 CR

4K SXRD
Sep 04
4K projector SRX-R110 (introduced at Digital Cinema Laboratory in Hollywood, CA), resolution of 4096x2160, compatible with 2K projectors of 1920x1080, judged as with a picture quality of at least 35 mm, 10000 ANSI lumens, 3000:1 CR (expected at 2000:1 in the production units), expected in theaters by 2005, dual-screen mode for the projection of dual 1920x1080 images, and quad-mode for four 1920x1080 images, $80000, $15000 extra for lens, TTM Jan 05, suitable for up to 40 feet wide screens.

SRX-R105 $60000, 5000 lumens, suitable for up to 25 feet screens.

Sony Black Screen
Sony introduced their new screen designed to reflect only red, green, and blue wavelengths with a 2.1 gain, absorbing all ambient light in the room. The screen measures 80 inches and will be sold for about $2000, TTM next summer. The screen was shown at CES 2005 mating Sony's Cineza VPL-HS51 LCD projector. The very large room they used for this screen was shared with all their other TVs, cameras, and equipment which required of sufficient light to been able to see all the components and read their specifications. Even with such lighting conditions the screen was still able to perform acceptably, according to Sony it is designed to perform properly with daylight.

Syntax

CES 2005
LCoS RPTV
Olevia line

50" LCT50HV $2100, TTM Dec 04, 1388x780 3-panel RGB, 1000:1 CR, 1000 Nits of brightness, 3:2 pulldown, wide 170/170 viewing angle, NTSC tuner, DVI/HDCP, YCbCr, YPbPr, VGA RGB for PC

61" $TBA, TTM end 05, ATSC tuner, 1920x1080p, NO 1080p input

Thomson
May 04 (company announcement of 2004/5 models)

Thomson join venture with China's CTL (TTE) starting in July 04 will produce for the US market eleven fully integrated ATSC and Digital Cable Ready models with QAM CableCARD unidirectional (seven RCA Scenium DLP models, four RCA CRT RPTV models), with HDMI, and with component inputs. The new sets are said to recognize the Broadcast Flag. According to TTE, the company will become the largest company in the world for color TV products; selling 18 million sets annually (with a 22 million production capacity), representing 11% globally.

CRT RPTV Integrated
Four new sets w/ATSC and QAM cable tuners, HDMI/HDCP, component, TTM fall 04
52" HD52W55 $1900
52" HD52W56 $2000
58 group
Subwoofer output, protective screen shield, SRS Focus
52" HD52W58 $2300
56" HD56W58 $2500

Current 42 Series DLP Integrated (continues in the line up)
ATSC/QAM cable in-the-clear tuners, includes EPG, Internet browser, HDMI, and IEEE-1394
50" HD50LPW42 $3800
61" HD61LPW42 $4300

CRT RPTV Monitors (carried over)
DVI/HDCP
52" D52W15 $1500
52" D52W20 $1700
56" D56W20 $2000
61" D61W20 $2200

CES 2005
Introduced 10 RCA CRT RPTV models in five Series
Integrated ATSC tuners, $ 1100 for the 52"

59 Series
52" HD52W59

64 Series
52" HD52W64

65 Series
56" HD56W65

66 and 68 series below with DVI and subwoofer
66 Series
52" HD52W66
56" HD56W66
61" HD61W66

68 Series

52” HD52W68
56” HD56W68

Introduced seven new direct-view CRTs integrated
ATSC tuner, displays 480i images (SDTV) in 4:3 AR:
27” $269, entry level
32” $<$400

CRT HDTVs direct-view 4:3 monitors
27”
32”

Toshiba
May 04 (company announcement of 2004/5 models)

Toshiba announced its 2004-05 television line to dealers. The new line is mainly oriented to fixed-pixel digital display technologies, such as direct-view LCD TV, plasma, Digital Light Processing (DLP) rear-projection integrated sets and monitors, in addition to CRT-based rear-projection and direct-view products.

In January 2004 (CES), Toshiba announced their decision of discontinuing the LCoS line, which is now replaced by their support to DLP.

CRT RPTVs
Analog and 4:3 aspect ratio sets are now discontinued
TheaterWide Monitors

46”	46H84	$1400, Jun 04, tabletop
51”	51H84	$1700, May 04
57”	57H84	$1900, May 04
65”	65H84	$2200, Jun 04

TheaterWide Integrated
QAM CableCard/ATSC tuners, IEEE-1394, TV Guide On-screen interface

51”	51H94	$2100, Jul 04
57”	57H94	$2300, Sep 04

Cinema Series Integrated
QAM CableCard/ATSC tuners, IEEE-1394, TV Guide On-Screen interface

51”	51HX94	$2400, Aug 04
57”	57HX94	$2600, Sep 04
65”	65HX94	$2900, Oct 04

Direct-view CRT Monitors
TheaterWide Line
HDMI

26”	26HF84	$700, Aug 04
30”	30HF84	$900, Jul 04
34”	34HF84	$1400, Jun 04

Cinema Series Line

30”	30HFX84	$1000, Aug 04
34”	34HFX84	$1600, Jul 04

At the time of the May 04 announcement of new 2004/5 lines Toshiba anticipated a demand for direct-view digital televisions and will keep producing complete lines of analog CRT direct-view models (curved and flat-faced).

Sep 04
SED

Toshiba and Canon have been working together since 1999 in a join venture for the development of SED panels, expected to be 55 inches and above. Flat panel TV with SED (surface-conduction electron-emitter display) technology is said to be similar than CRT beam-emitting technology to obtain comparable clear images but with a flat panel. SED handles fast images without jagged edges and consumes one-third the electric current needed by plasma. Although the first SED televisions could be available in 2005, full production is expected in 2006.

SED is formed by two glass plates with vacuum in between, one mounted with electron emitters and pixels similar in number to those of a CRT electron gun, and another glass plate coated with a fluorescent substance. The technology has a very narrow slit (several nanometers wide) made from ultrafine-particle film; reaction to voltage produces a tunneling effect and the emission of electrons, which are accelerated by the voltage applied between the glass plates and collide with the fluorescent-coated glass plate, which emits light.

SED has a wide angle of viewing, similar to CRT. Larger screens can be manufactured increasing the number of electron emitters to match the required number of pixels. SEDs do not need electronic-beam deflection. Wall-mounted large-screen TV displays can be made with only a few centimeters thick.

CES 2005
SED

SED products are expected to perform with 1 millisecond response time and 8600:1 CR, and are planned to be offered in late 2005/early 2006 at a price range of LCD-TV panels of equivalent size, starting with 50" model. The company expects SED panels to challenge the flat-panel market currently dominated by plasmas and LCD-TVs.

36" 1280x720, flat panel with CRT performance (demo)
50" 1920x1080, TTM late 05/early 06, $ TBA

CRT direct-view

Super-thin models will be introduced in 2005, with 30% less depth,

CRT Direct-view TryPlay widescreen line

26" $700, TTM Mar 05
30" $1000, TTM Mar 05
30" $1400, TTM Jun 05, integrated with ATSC/QAM tuners

Vidrikon

Jun 04 (Home Entertainment Expo)

FPTVs (in addition to the models 20 and 40 DLP FPTVs already introduced)

Model 60 D-ILA $13000, 3-panel, 1400x768 16:9 native, 1000 ANSI, 800:1 CR, TTM late summer 2004

Sep 04 (CEDIA introduction)
Model 80 D-ILA $30,000, 1920x1280, external processing, 1050 ANSI lumens, 2100:1 CR, DVI/HDCP, component

Yamaha

LCD FPTV

LPX-510 $5500, TTM Sep 04, 3x 0.7-inch LCD panels of 1280x720, DCDi, 10-bit D/A converter, 1200:1 CR, 1000 brightness with 200 watt UHP lamp (3000 hours expected life), HD component, HDMI/HDCP, RS-232

DLP RPTVs and FPTV Projectors

In professional products, DLP Cinema technology is now installed in over 250 commercial movie theaters in the world. Some of the DLP projectors used on those installations are made by Barco, Christie, Digital Projection, and NEC in the 1400x1050 and 1600x1200 resolutions. More than 130 movies have been digitally released.

TI intends to reduce the conversion costs of theaters to DLP, estimated in the range of $100,000 to 150,000, by involving producers and film distributors to help in the transition. One of the ideas is to charge theaters a fee for existing movies and create a fund to be used in the conversion investment that movie theaters are reluctant to afford.

Regarding consumer products, TI informally declared that their plans for the xHD3 1080p DMD chip are that it will stay as is, but it will receive some gradual improvements in the future, no details of what and when were provided.

The following are some of the latest innovations implemented by TI:

DynamicBlack™: Dynamically optimizes picture quality, providing deeper black levels with incredible detail in dark scenes and a contrast ratio of 5000:1.

DarkChip2™: The next generation of DLP's widely acclaimed

DarkChip™ technology; offers dramatically increased contrast ratio to provide increased depth, picture sharpness, and true blacks and whites

SmoothPicture™: Combined with our cutting-edge third generation of 720p and 1080p chips, it offers the ultimate in picture quality, providing a smooth, seamless image

HD2+: The latest enhancement to HD2 product line, it offers DarkChip2™ which enhances contrast for rich and detailed dark scenes

HD3: The next generation DLP chip, offers improved contrast and features DarkChip2™ and SmoothPicture™ technologies

xHD3: The first in the x-series of products, it offers 1080p resolution and the finest in picture quality with DarkChip2™ and SmoothPicture™ technologies

In May 2004, TI provided some technical detail of how the new HD3 chips were able to provide the claimed resolution, an issue that raised a number critic comments form DLP and non-DLP enthusiasts that were expecting a chip with a matching array of mirrors for the pixels of image to be displayed, not half of it, as follows:

For 1920x1080p resolution the .85" xHD3 chip has actually a mirror-array of 960x1080p.

For 1280x720p resolution.55" HD3 chip has actually a mirror-array of 640x720p.

Both chips have mirrors angled at 45 degrees so projectors will display half of pixels of the image in 1/120th of a second using the entire array of 960x1080 mirrors and, by shifting one image pixel via a moving mirror, display the other half of pixels in another 1/120th of a second, to total the full 1920x1080 image in two movements with the same 960x1080 mirror-array.

The theory is that, having as objective the building of a 1920x1080 image 60 times per second, it represents a savings if done with a smaller chip in two fast passes because the human eye would see both 1/120th fast half images as one of 1/60th.

At CES 2005, TI indicated that they are going change the naming convention of chips used until now, and refer to the chips as 720p and 1080p.

The 1080p technology is also a good match with the soon to be available HD-DVD (or Blu-Ray, or EVD, or WMV HD), and the D-VHS media available today. Consumers would be able to view high resolution content with no compromises on the display device.

Although, having now more devices that are able to display the full 1080x1920 resolution, we hope that we will not be subjected to signal quality constraints from multi-casting, satellite and cable over-compression, or from camera and distribution resolution limitations.

Owning true 1080p-software content, and been able to display it to its full resolution, would dramatically accelerate HDTV adoption, not necessarily for the reason of TV, but for experiencing high quality video in your own HD home theater.

Akay

RPTV

46" PT46DL20 $2300, TTM Nov 04, HD2 chip, ATSC tuner, no CableCARD slot, Circuit City distribution (another 46" set with different cabinet for Costco)

CES 2005

RPTVs

Fully integrated (ATSC/QAM CableCARD tuners) and monitor only options
HD3 chip
50"
52"
56" (not confirmed at CES time)

BenQ

CES 2005

FPTVs

PE8260 1024x768, 3200 lumens of brightness, 2000:1 CR, 802.11b for home-networking
PE8720 $11000, TTM Mar 05, 1280x720, 5500:1 CR, 8-segment color wheel, DCDi, 23db low noise level, 800 ANSI lumens, 5 BNC, component

BenQ PE8720 FPTV

PE7700 $3300, TTM Mar 05, 720p, 2500:1 CR
All the other HT models (11) are included in the CES 2004 report

RPTVs
57" $N/A, TTM N/A
72" $N/A, 11 inches deep, TTM 2006, TI DMD chip choice not decided yet, 720p probably followed by 1080p later.

Christie
FPTVs
1280x720, CERMAX Xenon lamp 1000 hours, 3-chip
DW3K 3000 ANSI lumens
DW6K 6000 ANSI lumens

Crystal View
Dec 04
FPTV
CV-720HD+ 720p, 1200 lumens, DVI, HDMI

Digital Projection Inc
FPTV
IVision HD-7 $20000, TTM 3Q04, 3000:1 CR, 1000 ANSI lumens, second generation chip, 1280x720

Dwin
CES 2005
FPTV
Transvision 4 $6500, TTM April 2005, Dark Chip 2 720p, native-rate outboard included

HP
Sep 04
FPTV
Single chip, TTM Sep 04

ep7120 $3000, screen size 37-110 inches, 850 ANSI lumens, 4000 hrs lamp life, XGA 1024x768, component, DVI/HDCP, VGA for PC

ep9010 $2500, built-in-DVD player, EDTV SVGA (800x600), 2.1 stereo subwoofer system, DVI/HDCP, VGA for PC

Infocus
June 04
FPTV
Model 777 3-chip HD2 prototype stage, $30,000, 12 degree tilt DMD, 2000 lumens, 3000:1 CR, DVI/HDCP, dig keystone correction +- 15 vertical degrees, uses FLI2310 DCDi next-generation Faroudja chip, 44.4 pounds, 30db fan, April 04 unofficial launch event, deinterlacing of 1080i by using 540 of each field to build a 1280x720 frame.

CES 2005
FPTVs
ScreenPlay 7210 <$7000, TTM Feb 05, Dark Chip 3 720p, Carl Zeiss l1.3x zoom lens, 1400 lumens of brightness, 2800:1 CR
ScreenPlay 4805 $1500, DCDi

RPTVs Integrated
ATSC/NTSC/QAM Cable CARD tuners, 1280x720, HDMI/HDCP, two IEEE1394/DTCP, AVC networking, TTM current
50" ScreenPlay 50md10 $7000
61" ScreenPlay 61md10 $9000, 3000:1 CR

61" TD61 $11000, 1280x720 HD2+, 1000:1 CR, DVI-I, 15 Pin-Dsub

LG
RPTVs
Slim, HD2+ chip, 1280x720, ten element lens system, DVI/HDCP, 3-2 pulldown, TTM 2Q04, air bearings:
44" RU-44SZ61D $4,000 (now $2700)
52" RU-52SZ61D $4,500 (now $3200), Cable-Card ready, ATSC tuner, HD2 Mustang chip, 1280x720, HDMI, RGB and 1394 inputs

FPTV
RD-JT91, SVGA resolution, 1700 ANSI lumens, 2000:1 CR, 25dB noise level, zoom ratio 1.2:1, lamp life 3000 hours, 6.4 lbs.

Sep 04
Integrated RPTVs
HD-2 Mustang chip, 1280x720, ATSC/QAM Cable CARD tuners, 120-watt bulb, air bearings color wheel for 50000 hours life (rather than 20000 hrs of ball bearing color wheel, according to LG)

52" DU-52SZ61D $3500, TTM fall 04, HDMI, RGB, 1394
62" DU-62SZ61D $TBA, TTM fall 04

44" RU-44SZ63D $2700, TTM fall 04, HD2+, 1280x720, XD-engine, DVI, HDMI

52" RU-52SZ51D $3200, TTM Fall 04, HD2+, 1280x720, XD-engine, DVI, HDMI

CES 2005
Integrated 720p RPTVs SX4D line
1500:1 CR, 1280x720 HD3, IEEE1394, HDMI/HDCP, ATSC/NTSC/QAM Cable CARD tuners, air bearing color wheel
52" 52SX4D TTM Apr 05
62" 62SX4D TTM Apr 05

Integrated 1080p RPTVs SY2D line
QAM cable w/CableCARD and ATSC tuner 5th generation chip, 1920x1080p xHD3 chip, HDMI, RGB, TTM 2005, 3000:1 CR, IEEE1394, air bearing color wheel
52"
56" 56SY2D TTM May 05
62" 62SY2D $4500, TTM May 05

Loewe
RPTV monitor
55" Articos 55 $7000 to $8000 depending on finish, Carl-Zeiss lens technology, HD2 chip, 1500:1 CR, DVI/HDCP, optional motorized swivel base ($1000) to reduce reflections changing the angle

Marantz
Sep 04 (CEDIA introduction)
FPTVs
VP-12S4 $13,500, HD2+ chip, TTM end 2004, 3 lenses, HDMI, 1280x720
VP-10S1 3-chip

Marantz VP-12S4 Gennum system was said to convert 1080i inputs to 1080p, and then scales down the 1080p image to 1280x 720. Other systems are known to converting down 1080i to 540p and then upscale to 1280x720, which is said to be more digital, jerky, and blocky.

Mitsubishi
April 2004 (company announcement of 2004/5 models)

The company announced the addition of six DLP high-definition sets between 52" and 62" to be available in the period Jul-Sep 04, and one 82" integrated LCoS micro display (Alpha's flagship RPTV). The sets are integrated with ATSC/QAM CableCARD unidirectional tuners, and have HDMI, and IEEE-1394 digital connections. These features are also included on most of the other newer sets of the 2004/5 lines. In total, the company is adding 18 new integrated ATSC/cable-ready models.

According to the product development director, Mitsubishi designed a proprietary light engine using the 0.85-inch DMD chip on their new DLP additions, a return from their original 65" DLP introduction in 2000 (MSRP $15,000 at that time), the company said. Diamond models will be distributed by A/V specialists, Medallion models by major accounts.

525 DLP Series Integrated RPTVs

TTM Jul/Aug 04, NetCommand 4.0 networking with Learning Media Command, "AMVP2" motion video processing
52" WD-52525 $4200

62" WD-62525 $5000

Medallion 725 DLP Series Integrated RPTVs
TTM Aug/Sep 04, same as 525 features plus TV Guide Onscreen IPG, Anti-Glare Diamond Shield
52" WD-52725 $4500
62" WD-62725 $5300

Diamond 825 DLP Series Integrated RPTVs
TTM Aug 04, 120GB HDD DVR for 12 hours HD, 72 hours SD, MPEG SD encoder, Gemstar guide, and subscription free

52" WD-52825 $5500
62" WD-62825 $6300

Oct 04 (InfoComm Trade Show)
FPTVs
Single chip
HC900U $3000, EDTV 1024x576, 4000:1 CR, CineRich color, CineView processing, 1500 lumens, DVI/HDCP, 300-inch screen capability, 6 pounds
HC2000U 1280x720, 700 ANSI lumens, HD2+, 3600:1 CR, 250" max screen size, DVI-I/HDCP, BNC, RGBHV, YPbPr

NEC
Sep 04 (CEDIA introduction)
FPTVs
HT410 $1500, 854x480 (EDTV)
HT510 1024x576, high-performance and low cost, component, and RGB inputs

CES 2005
FPTVs
EDTV resolution, 28 dB noise level, vertical manual lens shift, 1000 ANSI lumens, 1200:1 CR
NEC HT410 $1300, VGA 854x480
NEC HT510 $2000, XGA 1024x576

Optoma
Apr 04
RPTV
50" RD50+ HD2+ chip, under development, $N/A, 1280x720, DVI, RGB, BNC, 3000:1 CR, 8000 hrs lamp life, 450 nits brightness, IEEE1394 front input (camcorder)

Sep 04 (CEDIA announcement)
Sovereign RPTVs
HD2+ Dark Chip 1280x720p, HDMI to DVI adaptor, DVI-port audio cable, ISF calibrated on each port by manufacturer, 1% over-scan, DVI, HDMI, TTM 4Q04, 2500:1 CR, non-reflective screen

50" SV50XF $4000, 450 Nits of brightness
65" SV65XF $6000, 400 Nits of brightness

FPTVs (current)
H77 3500:1 CR, 23 DB noise level
H57 1024x576 16:9, six-segment color wheel, 2500:1 CR, VGA, DVI/HDCP, component, DVI to HDMI adaptor for HDMI sources

CES 2005
RPTV
65" RD65 1280x720, 1500:1 CR, IEEE1394 front input (camcorder)

HD504 Dark Chip 3, 720p, 2500:1 CR, 14.8" depth, 90 pounds

FPTVs
H79 Dark Chip3, 4000:1 CR, 1000 lumens, 1280x720p native, 8-segment color wheel, DVI-I/HDCP, DVI-I to HDMI adapter, component, 23 dB noise
H77 1280x720, HD2+, 3500:1 CR, 23 dB noise, 900 lumens, DVI-I/HDCP, DVI-I to HDMI adapter, component
H57 1024x576, Dark Chip 2, 3000:1 CR, DVI/HDCP, DVI-I to HDMI adapter, 28 db noise level, 3 component inputs, 1100 lumens
H31 $1500, Dark Chip2, 854x480, 3000:1 CR, DVI/HDCP, 850 lumens, HD scaling enhancement, successor of H30 model, 32 dB noise, component
H27 $TBA but estimated as $1300, TTM Apr 05, single 0.54-inch DMD Dark Chip 2, EDTV 854x480, 2300:1 CR, 800-1000 lumens of brightness, six-segment color wheel, DVI-D/HDCP, 15-pin D-sub RGB, component

MovieTime DV10 $1500, 854x480, Dar Chip 2, 4000:1 CR, 7.8 pounds, 1000 lumens, DVD player, 5-watt audio speakers

Panasonic
Oct 04
FPTVs
PT-D5500U/UL single chip FPTV, WGA, dual lamps, 4500 limens
PT-DW7000U 3-chip, 1366x768, 5000 lumens, pair of UHM lamps
DS+6K single chip, SVGA, 1400x1050, 6000 lumens
DS+4K single chip, SVGA, 1400x1050, 4000 lumens
DS-25 single chip, 2500 lumens

CES 2005
RPTVs
50" PT-50DL54 HD2+, 8-segment color wheel, 2500:1 CR, SD photo card slot
DLX75 Series
Two new models with ATSC/QAM Cable CARD tuners, 720p, TTM Aug 05, 2500:1 CR, SD and PCMCIA slots, RGB PC and HDMI/HDCP
56" PT-56DLX75
61" PT-61DLX75

Projection Design LLC
Oct 04
FPTVs
Action! Model Three $TBD, HD2+ 1280x720, 4000:1 CR, 4000 ANSI lumens, dual bulb design 2x250 watts, 8000 hrs of use, 32db operating noise,

Action! Model One MKII full upgrade, for 7-segment color wheel, etc

CES 2005
FPTV
F1+ 1400x1050, 2500 ANSI lumens, 2500:1 CR, 28 dB noise-level

Radio Shack
CES 2005
FPTV
Cinego package
D-1000 $1250, TTM early 05, Carl Zeiss D-9-home optical engine, DVD player and sound system included,

Runco
Jul 04
FPTVs
Video Xtreme Series
VX-2c This unit was announced in the CES 2004 report as TBA and TTM 1Q04, but no further detail could be provided at that time. The unit now is appearing as 3 x HD2 chips, 16x9 (1280x720), TTM Jul 04, 2500 ANSI Lumens (1199 HT ANSI measured with Runco's Cinema Standards Measurement System, CSMS), 52.1 foot –Lamberts, 3100:1 CR (271:1 measured with CSMS), six lens

options for up to 250 inches of screen (5 for zoom, one for RPTV), vertical shift of 60% down and 24% up, horizontal shift from 10 to 16% depending on the lens, DVI, Scan frequency: 15-100 KHz horizontal, 28-78 Hz vertical, 275Watts UHP lamp (life 2000 hours), and DHD digital video controller.

LiveLink DVI Cable System
The VX-2c is the first projector to use Runco's LiveLink technology for transmitting HD over DVI up to 75 feet (reported up to 120 feet but 75 is the manufacturer spec), supports data rates from 25Mbps to 1.65 Gbps, HDCP compliant, DVI 1.0 compliant supports 720p and 1080i resolutions available in 25, 35, 50 and 75 feet.

The following other projectors are still current, check the CES 2004 report:
VX-4c
VX-6c
CL-710
CL-710LT
VX-1000ci

CES 2005
FPTVs
Video Xtreme Series
With Digital Video Controller (DHD) at 720p, DVI/HDCP, component, Vivix Processing
VX-1000D 1280x720 HD2+, 2770/3300: 1 CR, 1500 ANSI lumens
VX-4000D 1280x720 HD2+, 1600 ANSI lumens, 3400/4000:1 CR
VX-5000D 1280x720 HD2+, 1700 ANSI lumens, 4400/5000:1 CR

CineWide technology for 2:35 AR installed in CL-710, and all six projectors above

CL-410 $3500, 1024x576, DVI

Samsung
Jun 04 (company announcement of 2004/5 models)

A year ago, at CES 2004 Samsung informally projected that in July 2004 they would make available to the consumer a 1080p DLP RPTV line implementing TI's new xHD3 Digital Micromirror Device (DMD), followed by a 1080p DLP FPTV in November. The line for 1080P RPTV was said to include sizes of 50", 56", and 61", at a projected range of $4000 to $6000. In June, the company formally confirmed the initial release of the 1080p RPTV line for later this fall to be made available to select A/V retailers, using a new design of their light engine (fifth-generation).

97 Series RPTV 1080p Line
61" HL-P6197W $6500, TTM Nov 04, 3000:1 CR, seven-segment color wheel, integrated ATSC/QAM unidirectional CableCARD tuners, to be distributed through select A/V retailers. The $6000 projected MSRP upper range (for the larger set), provided in January at CES, was close to June's confirmation.

In June's announcement no confirmation was issued about the release of the other smaller screens of the line, however, in September Samsung showed at CEDIA (September 04) the 56-inch model of this xHD3 1080p line:

56” HL-P5697W MSRP expected to be between $5500/$6000, TTM 1Q05, 3000:1 CR, pedestal base design, integrated with ATSC/NTSC/QAM Cable CARD tuners.

In June Samsung announced the release of nine fully integrated/CableCARD-ready rear-projection HDTV sets, six transitioned as HDTV monitors, three integrated models expected for release between September and November. Other DLP models will be transitioned to become integrated w/CableCARD to comply with the FCC mandate with the objective of eventually discontinue the manufacturing of HD DLP monitors.

Integrated CableCARD models transitioning from monitor versions are identified with a number 7 on the last digit of the model number (instead of the 3 of the monitor version). At CES 2004, the company anticipated that integrated versions would be priced $500 above the monitor versions below, expected for later in 2004.

<u>63 Series DLP RPTV Monitors</u>
Will be distributed by national accounts, TTM Jun/Jul 04, 0.55” HD3 DMD chip with third-generation light engine, 1500:1 CR, improved brightness over 2003’s HD2 models, one DVI and one HDMI inputs, two component video inputs,

46” HL-P4663W $3300 (now $2700)
50” HL-P5063W $3700 (now $3000)
56” HL-P5663W $4200
61” HL-P6163W $4700 (now $3800)
The 56” is for regional accounts, but will also be available to national accounts by special order only

<u>70 Series DLP RPTV Monitors</u>
Will be distributed by the PRO group and select A/V specialty retailers, 0.85” HD2+ DMD chip with fourth-generation light engine, claimed to have increased switching speed, reduced pivot point and higher reflective surface area for improved contrast (2500:1 CR) and brightness, improved optics and screen designs
46” $4000
56” $4500

<u>Monitor Pedestal DLP RPTV Models</u>

TTM Jul 04, HD2+ DMD chip, fourth-generation light engine, HDMI, DVI, PC inputs, component video inputs
50” HL-P5085W $4300, distribution by national accounts
56” HL-P5685W $5000, distribution by regional accounts

<u>Reduction of price on HLN models</u>:
In March 2004 Samsung announced a $500 reduction

of prices on the earlier 2003 DLP rear-projection HDTV lineup, the 43" entry model HLN4365W is now $3200 MSRP, the 50" HLN5065W is now $3700 MSRP, and the 61" HLN617W is now $4700 MSRP.

CES 2005
RPTVs
The company will expand the line from 8 to 12 models, and anticipating a 12-15% price reduction over the 2004 DLP RPTV lines.
67 Series Integrated
ATSC/QAM CableCARD/NTSC tuners, TTM Apr 2005, IEEE1394, 720P
46" HLR4667W $2700
50" HLR5067W $3000
56" HLR5667W $3500
61" HLR6167W $3800

Monitor versions of these sets were released mid-2004 as the 63 Series above.
720p RPTV
50" HLR5087W $3700

1080p Integrated RPTVs
ATSC/QAM Cable CARD tuners, all accept 1080p externally, TV-stands $300-$400.

56" HLR5688W $5000, TTM Feb/Mar 05, 1920x1080p, 5000:1 CR, DNI-e, IEEE1394. Apparently, this is the final version of the set announced in the 97 series last year (planned for 1Q05), mentioned at the beginning of the Samsung group

Series 68 of integrated 1080P
56" HLR5668W $4200, TTM Jun 05
61" HLR6168W $4500, TTM Jun 05
67" HLR6768W $7000, TTM Jun 05, 1920x1080, "floating screen" cosmetic design, 1080p "world largest DLP RPTV" according to Samsung

70" HLR7078W $8000, TTM Jul 05, 1920x1080p, accepts 1080p externally, integrated with ATSC/QAM Cable CARD tuners, IEEE1394, Gemstar EPG


Samsung 61" 1080p HLR6168W RPTV


Samsung 67" 1080p HLR6768W RPTV

FPTVs
SPH-500B $3500, TTM Feb 05, EDTV 1024x576
SPH-700AE

Sharp
FPTV
XV-Z2000 $4500, TTM Nov 04, 720p, 1200 ANSI lumens, 2500:1 CR, HD2+ 1280x720, DVI/HDCP, component

Sharpvision XV—200U TTM Jan 04(details included in 2004 report)

CES 2005
FPTV
Sharpvision XV-Z12000 $11000, TTM now, 5500:1 CR, 900 ANSI lumens, optical engine co-developed with Minolta, 3-position powered iris control, 1280x720 HD2+, DVI-I/HDCP, film-tone mode, 61-step color temperature adjustment, 33 dB noise

Sharpvision XV-Z10000 1280x720 HD2, 2600:1 CR, 6-segment color wheel, DVI/HDCP, 800 ANSI lumens, 32 dB noise, 300" maximum screen size

RPTVs
Four new DLP models in two series marking the company's return to RPTV (started w/CRTs)
650 Series
Integrated ATSC/NTSC tuners, no cable tuner, 1200:1 CR, 150 degree viewing angles, HDMI, component
56" 56WDR650 $3300, TTM Mar 05
65" 65WDR650 $3800, TTM May 05
750 Series
HD4 DLP chip, integrated with QAM CableCARD/NTSC/ATSC tuners, 720p HD4 chip, EPG, $TBA, HDMI, component, 2000:1 CR, DVI-I, two component inputs, Gemstar
56" 56WDR750 TTM 3Q05
65" 65WDR750 TTM 3Q05


Sharp 56" 56DR750 RPTV


Sharp 65" 65DR750 RPTV

Sim2
Sep 04 (CEDIA announcement)
FPTVs
Grand Cinema HT

HD2+ DarkChip3 projectors, 0.8-inch 720p chip with smaller mirror hinges, and reduced gaps between mirrors, DCDi, 3500:1 CR
HT300 E-LINK $15000, DVI/HDCP, DigiOptic Image Processor
HT300 E $12000, HDMI/HDCP

3-chip projectors with HD2+ chips
HT500 E-LINK DVI
HT500 E CR 4300:1, DCDi 2nd generation, HDMI

RPTVs
Domino
55M $7000, TTM Oct 04, HD2, 1280x720, 1800:1 CR, component, HDMI/HDCP, DCDi, 6-segment color wheel, 15.9" depth

Grand Cinema RTX
HD2 Mustang 16:9, 1280x720, DCDi, outboard processor linked w/fiber optic cable to the RTX set, 16 inputs in outboard, 8000:1 CR, 6000 hours lamp
45"
55"

CES 2005
RPTV integrated
The company returned to RPTV. Specs and TTM TBA
56" 56DR650
65"

FPTVs
Demonstrated the HT-500 line
Introduced the EXSX1, 1400x1050, 2500:1 CR

Studio Experience
Apr 04
FPTV
Premiere 30, ship by mid march, $TBA, Matterhorn chip, 2000:1 CR

Thomson/RCA
May 04 (company announcement of 2004/5 models)

As mentioned on the previous section Thomson join venture with China's CTL (TTE) starting in July 04 will produce for the US market eleven fully integrated ATSC and Digital Cable Ready models with QAM CableCARD unidirectional (seven RCA Scenium DLP models, four RCA CRT RPTV models), with HDMI, and with component inputs. The new sets are said to recognize the Broadcast Flag. According to TTE, the company will become the largest company in the world for color TV products; selling 18 million sets annually (with a 22 million production capacity), representing 11% globally.

"Profile" Scenium DLP Integrated
Ultra-thin two new models, ATSC/QAM CableCARD tuners, TTM Sep 04, 6.85 inches deep and less than 103 pounds make them suitable for wall hanging, hanging bracket sold separately, dual IEEE-1394 two-way/DTCP, TV Guide Onscreen EPG and

Internet browser, will detect broadcast flag, HD2 chip, HDMI/HDCP, dual component HD inputs
50" HD50THW263 $5000 (updated price Jan 05)
61" HD61THW263 $7000 (updated price Jan 05)
Thomson did not update/confirm the status of the future 70" DLP mural-sized set announced in January at CES (HD70THW263), expected for early 2005, hopefully they on track.

Other Scenium DLP RPTV Integrated
Five new sets, 16 inches cabinet depth, under 100 pounds, HDMI/HDCP, ATSC/QAM w/CableCARD/NTSC tuners, 160 degree viewing angle, component, HD2 chip, controls DVR functions of optional DVR2080

164 Series
50" HD50LPW164 $3100
61" HD61LPW164 $3700

165 Series
IEEE-1394, Internet browser, TV Guide EPG, TTM fall 04
44" HD44LPW165 $3700 (now $3000)
50" HD50LPW165 $4000 (now $3400)
61" HD61LPW165 $4600 (now $4000)

CES 2005
Announced ten new DLP integrated models with ATSC/QAM Cable CARD tuners, HDMI/HDCP ranging from 44" to 61", where the 44" model would be priced below $2000, among them:

52 Series
50" HD50LPW52
61" HD61LPW52

62 Series
44" HD44LPW62
50" HD50LPW62
61 HD61LPW62

175 Series
50" HD50LPW175
61" HD61LPW175

167 Series
44" HD44LPW167
50" HD50LPW167
61" HD61LPW167

Toshiba
May 04 (company announcement of 2004/5 models)

Toshiba announced its 2004-05 television line to dealers. The new line is mainly oriented to fixed-pixel digital display technologies, such as direct-view LCD

TV, plasma, Digital Light Processing (DLP) rear-projection integrated sets and monitors, in addition to CRT-based rear-projection and direct-view products.

In January 2004 (CES), Toshiba announced their decision of discontinuing the LCoS line, which is now replaced by their support to DLP. In May, Toshiba formally announced the addition of 10 RPTV DLP sets and monitors implementing the pairing of the HD2+ chip of Texas Instruments (0.8-inch Digital Micromirror Device - DMD) with the Toshiba Advanced Light Engine (TALEN). The company's two-year goal is to position their DLP products within the top-three DLP TV manufacturers, by using advance optics together with the HD2+ DMD chip, as opposed to the HD3 chip-based sets of the competition.

New models of fully integrated HDTV sets include ATSC/QAM tuners with CableCARD slots for unidirectional digital cable ready capability, and TV Guide Onscreen interactive program guides. Most sets also include both HDMI/HDCP and IEEE-1394/DTCP digital interfaces.

DLP RPTVs

HD2+ chip, Magic Square Algorithm for smooth color gradation, Dynamic Contrast Enhancer for higher contrast, color purity, and saturation, Super Real Transient and Small Signal Sharpness for sharp transitions from dark to light, Color Transient Improver and Color Detail Enhancer, flat-panel plasma displays type of look, silver cosmetics and thin cabinets, and under-screen glass component cabinets.

TheaterWide Series DLP RPTVs
Silver cabinets with a gray bezel
HM84 Tabletop Monitors
TTM Jul 04

46"	46HM84	$3000
52"	52HM84	$3500
62"	62HM84	$4000

HM94 Tabletop Integrated
ATSC/QAM CableCARD tuners, IEEE-1394, DTVLink, HDMI, TTM Sep 04

46"	46HM94	$3400
52"	52HM94	$3900
62"	62HM94	$4400

Cinema Series DLP RPTVs
Same as TheaterWide Series plus cabinetry with black bezel accents, virtual Dolby surround sound, 6-item A/V illuminated remote
HMX84 monitors

52"	52HMX84	$3800, TTM Aug 04
62"	62HMX84	$4300, TTM Sep 04

HMX94 Integrated
Two HDMI, TTM Oct 04

52"	52HMX94	$4200
62"	62HMX94	$4700

Note the price difference of $400 for tuner integration as opposed to the previous year higher price difference.

Sep 04 (CEDIA announcement)

FPTV
TDPMT200 $1800, EDTV 480p, 2000:1 CR

CES 2005
FPTV
TDPMT800 $8000, HD2+ 1280x720, accepts 1080p, Carl-Zeiss lens, DCDi, 7-segment color wheel, 2200:1 CR, 1100 ANSI limens, two component, DVI/HDCP

Two new DLP 1080p engines will be announced on the next spring dealer show. A second generation of models (Talen X) is planned for introduction during 2005.

Vidikron
CES 2005
Vision Models w/DVI-I/HDCP

20 $5500, TMM Jun 03, HD2, 1024x576, 850 ANSI lumens, 1500:1 CR

25 $6000, TTM Feb05, 1024x756, 900 ANSI lumens, 1600:1 CR
40 $9000, TTM Jun 03, 1280x720 HD2+, 950 ANSI lumens, 1600:1 CR
45 $10000, TTM Feb 05, 1289x720 HD2+, 1000 ANSI lumens, 1700:1 CR
100 $30000, 3-chip, 1280x720, 3500 ANSI lumens, 2000:1 CR, DVI/HDCP

Viewsonic
Jun 04 (InfoComm introduction)
FPTVs
PJ255D $2000, 2.1 pounds, 1024x768, 2000:1 CR, 1100 lumens
PJ520 $1500, 5.9 pounds, SVGA 800x600, 2000 lumens,
PJ1165 $4300, wall/ceiling installation, 3500 lumens, 800:1 CR, 1024x768

RPTV
Oct 04
56" N5600W 1280x720, DDR, HD2+ chip

V, Inc.
Jun 04
RPTV monitor
56" RP56 $3,000, 1280x720, HD2 chip, 19 inch cabinet, 1500:1 CR, DVI/HDCP, selective color space for PC (0-255) or HD (16-235), dual NTSC tuners, DCDi, PC RGB, 3:2 pull-down

Yamaha
Sep 04 (CEDIA announcement)
FPTV
DPX-1100 $12500, TTM Apr 04,

HD2+ chip, 1280x720, 2.7-5.0 lens with motorized iris control, 270 Watt UHP lamp with variable power control up to 800 lumens of brightness, 4000:1 CR, DCDi, Faroudja TrueLife Enhancement circuitry, HDMI/HDCP, component with BNC, RGB, RS-232, 30 dB noise level

CES 2005
FPTV
DPX-1200 $13000, TTM Feb 05, 720 Dark Cip3, 5000:1 CR, 800 lumens, 1.6 motorized zoom lens

Plasma Panels

Akay
TTM Feb 05, component, DVI/HDCP, monitors
42" PDP420QHD $2800, 1024x1024
50" PDP500QDH $4500, 1366x768

CES 2005
TTM Feb 05
42" EDTV $1200
50"

AKIRA
May 04
63" HPT-630A $TBA, 1000:1 CR, 1000 cd/m2 brightness, user selectable color temp from 3200 to 9300 degrees Kelvin, dual NTSC/ATSC tuner, DVI-I/HDCP, network Ethernet connection

Audiovox
Mar 04
First plasma panels under the Acoustic Research brand name for specialty retailers

42" AR4200 EDTV, TTM 2Q04, $4500, 8521x480, one NTSC tuner, DVI/HDCP, component
50" AR5000 HDTV, TTM 2Q04, $7600, 1366x768, dual NTSC tuners, DVI/HDCP, component

Crystal View
Dec 04
50" CVP-50 1100:1 CR

Dell
Oct 04
New models, dual NTSC tuners, PIP, 20-watt audio, DVI/HDCP
42" W4200HD $3500, TTM Nov 04, HDTV, ATSC tuner, 1024x768, 450 nits, 2700:1 CR
42" W4200ED $2300, TTM Nov 04, EDTV, 852x480, 420 nits, 2300:1 CR

Dwin
Sep 04 (CEDIA announcement)
PlasmaImage HD series
Two component design with TranScanner control box/processor/scaler, 12-bit color processing, DVI/HDCP connection to the panel, two DVI/HDCP inputs, two RGB, two component, screen saver for burn-in prevention
42" HD-142 $9000, 1024x768

Two larger models below with 1365x768, TTM current
50" HD-150 $11000
61" HD-161 $20000

CES 2005
Plasma image POR Series
DVI-D/HDCP, RGBHV, RGB/PC, up to 9000 feet
42" PRO-142 1024x768
50" PRO-150 1365x768
61" PRO-161 1365x768

New Video Processor
Duo Vision HD Dual-display system to supply DVI/HDCP digital connectivity to TransVision 3 720P DLP projector and PlasmaImage series plasma panels from one central location simultaneously from up to 100 feet away using Dwin DVI Cable Extender ($245). The Duo Vision is suited with two DVI/HDCP and two component inputs and packages are priced from $18000. It can only be used to Dwin displays designed for this interface.

Faroudja
CES 2005
42" FPP-42HD30 $N/A (special order 3-4 weeks), 1024x768
50" FPP-50HD30 $13000, TTM Jan 05, 1365x768
61" FPP-61HD30 $22000, TTM now, 1365x768

Video processors for panels above:
DVP1010 and DVD1510 (included in the DILA FPTVs and processors sections)

Fujitsu General
Apr 04
The company has cut the prices of five of their monitors
50" P50XHA30WS from $11,000 to $9,000
55" P55XHA30WS from $15,000 to $12,000

The other Plasmavision Slimscreen models remain unchanged, among which:
42" P42VHA30WS $5000
42" P42HHA30WS $7000
63" P63XHA30WS $25000

New 2004 models for Commercial market:
42" P42HCA30WH $7000
42" P42VCA30WH $5000
50" P50XCA30WH $11000

Sep 04
PlasmaVision monitors
AVM II processor, DVI-D/HDCP, RS-232, built-in stereo amp, TTM was TBA in fall, $ was TBA in fall, MSRP prices reflect recent reductions
42" P42VHA40US $4000, TTM now, 852x480 EDTV, 852x480
42" P42HHA40US $5500, TTM now, 1024x1024 HDTV, 1000:1 CR

50” P50XHA40US $7500, TTM now, 1366x768, 3000:1 CR
55” P55XHA40US $10000, TTM Jan 05,1366x768, 900:1 CR
63’ P63XHA40US $18000, TTM 2Q05, 1366x768, 3000:1 CR, HDMI, 160 degrees viewing angle

Monitors
42” PDM-4210
55” PDM-5520
63”

Hitachi
June 2004 (company announcement of 2004/5 models)

Ultravision HDT51 Series Integrated
TTM 3Q04, CineForm cosmetics, dual HDMI, dual 1394, Quick Start Seamless ATSC/NTSC/QAM CableCARD tuners, Virtual HD 1080p processing, USB, inputs/outputs housed on Hitachi’s AV Center connected via single wire to panel and controlled with IR from screen for hide away installations
42” 42HDT51 $6000, 1024x1024, AliS technology

55” 55HDT51 $10000, WXGA 1366x768

Ultravision HDX61 Director's Series Integrated
Same features as HDT51 line plus enhanced industrial design w/high gloss, black trim, high-contrast deep black shield, two year warranty, TTM 3Q04
42” 42HDX61 $7000
55” 55HDX61 $11000

Plasma EDTV Monitor
42” 42EDT41 $4300, Virtual HD 1080p processing, 480p, DVI/HDCP, NTSC tuner, DVI/HDCP, TTM 2Q04
Plasma Professional Panel
42” CMP420V $3500, DVI, 853x480, V1 black frame version, V2 silver frame

HP
Sep 04
Piano black, less 4 inches deep, VFS, DCDi, 3:2 and 2:2 pull-down conversion for film, dual integrated NTSC tuners, PIP, DVI-D/HDCP, component
42” PE4240N $3000, EDTV (852x480), optional wall bracket/attachable speakers/subwoofer
42” PL4245N $5000, 1024x768, 3000:1 CR

HUMAX
Mar 04
First plasma

42” $4500, 1024x1024, ATSC tuner

JVC

CES 2005

Two model new line

XGA resolution upconverted to 770p using DIST, ATSC/QAM Cable CARD tuners (within the included outboard media box), HDMI, dual IEEE1394, dual HD component

42”

50”

LG

Jul 04

71” MW-71PY10 $N/A, TTM fall 2004, monitor, see below confirmed availability at CES

On Sep 04 at CEDIA LG announced the availability by fall of a new line of panels with integrated QAM/ATSC w/Cable CARD tuners, 5th generation 8VSB for improved multipath performance, “Double Life” technology which extends to 60000 hours the life of their plasma displays, DVI/HDCP, HDMI, 1394, RS-232, PC connection, PIP/POP/split-zoom and twin picture, 1000cd/m2 brightness, 3000:1 CR, four exclusive image –sticking prevention options, XD engine, Gemstar TV Guide IPG.

42” DU-42PY10 $6000 (also announced as $5500)
50” DU-50PY10 $7000 (also announced as $6500)
60” DU-60PY10 $17000 (also announced as $15000)

CES 2005

Plasma Integrated panels

TTM Mar 04, integrated with ATSC/NTSC/QAM Cable CARD tuners, 160GB DVR, EPG, XG engine, four burn-in prevention processes, 1366x768, IEEE1394, HDMI/HDCP

50” 50PY2DR $9000
60” 60PY2DR $12000 (also reported as $16000)
60” 60PY2D TTM Apr 05

Other Integrated plasmas

ATSC/NTSC/QAM CableCARD tuners, 5000:1 CR

42” DU-42PX12X TTM Jan 05, 1024x768, DVI/HDCP

ATSC/NTSC/QAM CableCARD tuners, 5000:1 CR, HDMI/HDCP, IEEE1394, LG’s XD Engine

42” 42PX4D TTM Mar 05, 1024x768
50” 50PX4D TTM Apr 05, 1366x768

42” 42PX5D TTM Apr 05, 1024x768
50” 50PX5D TTM Apr 05, 1366x768

Oversized Monitor

71” MW-71PY10 $75000, Feb/Mar 05, 1920x1080p, integrated ATSC/NTSC/QAM Cable CARD tuners, 800 cd/m2 brightness, 1200:1 CR, DCDi, HDMI, DVI, component, 3-months waiting list, 5000 units production, limited distribution to

New York, Chicago, and Los Angeles. A Gold package version with audio system available for the Korean market only, for $100000.

Apparently, the 76" introduced at CES 2004 one year ago was dropped from the plans of actual production.

Luce/Epoq
Apr 04
HDTV panels
TTM current, all integrated with ATSC/NTSC tuners
42" $6500
50" $11000
63" $23000

EDTVs
42" $6,000
50" $9,000

Oct 04
42" MU-42PZ90XC monitor

Sep 04 (CEDIA announcement)
Integrated HDTVs
With ATSC/NTSC tuners, DCDi, DVI/HDCP, component, VGA
42" STV-42A2 $4300, 1024x768, 3000:1 CR, 1000 cd/m2 brightness
50" HTV-50A2 $11000, 1365x768, 3000:1 CR, 1000 cd/m2 brightness
63" HTV-63A2 $23000, 1365x768, 850 cd/m2 brightness, 950:1 CR

Integrated EDTVs (NTSC tuners only)
42" STV-42A0 $4000, 853x480, 1500:1 CR, one tuner
42" STV-42A2 $4300, 853x480, 3000:1 CR, 1000 cd/m2 brightness, dual NTSC tuners

HDTV Monitors Renaissance Series
43" HVM-42A3 $6000, 1024x768
50" HVM-50S2 $9000, 1366x768

Marantz
Sep 04 (CEDIA announcement)
Black bezel, HDMI, monitor only, TTM Sep 04
42" PD 4230 $6000, EDTV
42" PD4250 $9000
50" PD5050 $11000

Maxx Products
TTM current, component, DVI, D-Sub
TruVision 42 $4500, 852x480, 3000:1 CR
TruVision 42HD $6500, 1366x768, 3000:1 CR
TruVision 50HD $7000, 1366x768, 3000:1 CR

Mitsubishi
April 2004 (company announcement of 2004/5 models)

Plasmas Medallion Series
TTM Oct 04
42" PD-4245 $5000, 480x852 EDTV, MonitorLink DVI, speakers, stand
50" PD-5050 $8500, 768x1365 HD monitor, HDMI

61" PD-6150 $18000, 768x1365 HD monitor, HDMI, improved brightness and contrast

Motorola
Feb 04
TTM middle 2004
42" PG-H42 $6000, 1024x768, 3000:1 CR
42" PD-S42 $3500, 852x480 EDTV, 1000:1 CR

Moxell
CES 2005
Proview line
Faroudja video processing, HDMI inputs, some w/integrated ATSC tuner
42" MH-422HU $3500, TTM Jan 05, HDTV, monitor only
42" MH-422SU $2200, TTM now, EDTV, monitor only
46" MH-462SU $3200, TTM now, EDTV, monitor only
46" MH-463SU $3500, Apr 05, EDTV 852x480
46" MH-463HU $4500, May 05, HDTV 1024x 768
50" GP-650D $6200 (also reported as $5200), Feb 05, 1366x768, monitor only

NEC
Sep 04 (CEDIA announcement)
Four plasma monitor panels are available now, DVI/HDCP, RGBHV, and HD component:
42" 42VR5 $3000, EDTV 853x480
42" 42XR3 $5800, HDTV 1024x768
50" 50XR4 $8000, 1365x768
61" 61XR3 $15000, 1365x768

Optoma
CES 2005
50" SVP5F $6000, TTM Jan 05, 1366x768, 400 Nits of brightness, 3000:1 CR, component, DVI/HDCP, 15-pin D-sub RGB

Panasonic
Sep 04
ONYX XVS series
Next generation plasma products
Two piece configuration w/Media Box outboard, ATSC/NTSC/QAM CableCARD tuners, two component video, HDMI/HDCP, PC input, 16-watt detachable speakers, PCMCIA flash memory cards.

42”	TH-42XVS30V	$7500, TTM Oct, 1024x768
50”	TH-50XVX30V	$9500, TTM Oct, 1366x768

65”	TH-65XVSS30V	$20000, TTM Nov 04, 1366x768

Panasonic has cut the prices of the following integrated plasmas as of Sep 04:

37”	TH-37PX25U	$4000
42”	TH-42PX25U	$5500
50”	TH-50PX25U	$7500

EDTVs

37”	TH-37PD25U	down to $2500
42”	TH-42PD25U	down to $3000

According to Panasonic’s marketing information, the company has 23 % of plasma market in all channels (CEDIA Sep 04)

Oct 04
Viera

65”	TH-65DX300A	$23000 in Japan, 3000:1 CR, 1366x768, 60000 hrs life

CES 2005
Introduced six new plasma panels
ATSC/NTSC/QAM CableCARD tuners, EPG, PCMCIA and SD memory card slots, HDMI/HDCP, 3000:1 CR, 8.6 million colors, sub-pixel control increases horizontal resolution by 30% over previous models

PX500 Series
TTM Jun 05

42”	TH-42PX500U	

50” TH-50PX500U

PX50 Series
37” TH-37PX50U TTM Mar05
42” TH-42PX50U TTM Apr 05
50” TH-50PX50U TTM Apr 05

PD50 Series
42” TH-42PD50U TTM Mar 05

And an oversized 65” panel
65” TH-65PHD7UY $16000

Philips
Jun 04
Ambilight series
42” 42PF9976 $5500
42” 42PF9966 $6500, TTM Jul 04
50” 50PF9966 $8800, TTM Jul 04

Pioneer
Jun 04
Six new plasmas to be introduced, two are with digital cable ready (DCR), Pure Vision line, Pure Drive technology for converting analog sources to digital, QAM integrated tuner, Passport on-screen EPG, two HDMI/HDCP, two 1394, $ N/A, TTM Sep 04:
43” PDP-4345HD XGA 1024x768
50” PDP-5045HD 1280x768

Elite versions in the same sizes were announced but not introduced.

Sep 04
Pure Vision Elite
Integrated panels
XGA, TTM Nov 04, HDMI/HDCP, ATSC/dual NTSC, QAM CableCARD tuners, Pioneer’s Passport Echo EPG
43” PRO-920HD $11500 (also announced as 10500)
50” PRO-1120HD $15500 (also announced as 13500)

Monitors
TTM Nov 04, two HDMI/HDCP
43” PRO-810HD $9000

50” PRO-1010HD $13000 (also announced as 12000)
61” PRO-1410HD $20560 in Japan, 1365x768, 135 pounds, Advanced Pure Cinema for film-based content that employs 3:3 film detection at 72 Hz, Pure Color Filter II to improve color performance

Oct 04
43” PDP-434CMX
50” PDP-504CMX
61” PDP-614CMX

CES 2005
50HD Series
Two piece design, ATSC/NTSC/QAM CableCARD tuners, HDMI
43” PDP-4350HD $7000, TTM May 05, 1024x768, 1100 cd/m2 brightness
50” PDP-5050HD $9000, TTM Jun 05, 1280x768, 1000 cd/m2 brightness

A5HD Series
One-piece chassis integration, ATSC/NTSC/QAM CableCARD tuners
43” PDP-43A5HD $TBA, TTM May 05, 1024x768, 1100 cd/m2 brightness
50” PDP-50A5HD $TBA, TTM May 05, 1280x768, 1000 cd/m2 brightness, HDMI

EDTV monitor
42” PDP-4200ED $2500, 853x480, DVI/HDCP

Planar
May 04
(Model included because it was missing on my 2004 report)
42” PDP42HD under $4000, 1024x768, 800:1 CR, 750 cd/m2 brightness, comp, DVI, RGB 15 pin, TTM now

Plastract
In Mar 04, the company introduced a new plasma panel that permits the viewing of 4:3 images using a retractable top to avoid the use of black bars when detecting the incoming signal, www.noblackbars.com
42” $TBA, TTM Apr 04, 1366x768 to 1366x1366

Polaroid
42” PLA-4260 $3300, TTM Jan 05, 1024x768, DVI/HDCP, component

Revox
32” E1032 $8000, TTM current, 1024x852, component BNC, DVI
42” E1042 $10000, TTM current, 1024x1024, component BNC, DVI
50” E1050 $14000, TTM current, 1280x768, component BNC, DVI

Runco
CES 2005
Cinema Wall Monitor panels
Vivix Processing

42” CW-42HD 1024x768, high alt to 9000 feet, DVI/HDCP, 1000:1 CR, RGB
42” CW-42i 853x480, high alt to 9000 feet, DVI/HDCP, 1000:1 CR, RGB
43” CW-43MC 1024x768, DVI/HDCP, RGB, 1000:1 CR, controller included
50” CW-50mc 1280x768, DVI/HDCP, controller, 1000:1 CR, RGB
50” CW-50xa 1365x768, DVI/HDCP, high alt to 9000 feet, RGB
61” CW-61 1366x768, DVI/HDCP, high alt to 9000 feet, 1000:1 CR, RGB

Samsung
Feb 04
42” SPP4231 $4300, TTM Apr 04, 852x480, 3000:1 CR
42” SPP4251 $5000, TTM Apr 04
42” HPN4259 $6500, TTM Apr 04, 1024x768
50” HPP5061 $9000, TTM summer 04

Oct 04
42” PPM42SQ3 $N/A
50” $9000, TTM fall 04, 802.11a wireless connection up to 30 feet to STB, NTSC tuner in the STB
63” PPM63WQ3 $N/A
80” Showed again as a prototype, introduced at CES 2004

Integrated panels (55” w/DTV tuners)
37” HPP3761 $4000, dual NTSC tuners, 1000:1 CR, 1000 cd/m2 brightness
42” HPP4261 $5500, dual NTSC tuners, 900:1 CR, 1366x768, 1000 cd/m2
55” HPP5581 $10000, QAM CableCARD and ATSC tuners, panel from Fujitsu/Hitachi factory, TTM Oct 04, 3000:1 CR, 1000 cd/m2 brightness, DVI/HDCP
63”

Samsung abandoned their efforts for ultra-wide band UWB technology and rather supported 802.11a to connect wirelessly plasma panels with STBs.

Dec 2004
Samsung announced their development of a 102” plasma display with 1920x1080 pixels of resolution, 1000 candelas of brightness, and 2000:1 CR. The company declared that they are planning to invest about 30 billion won on the initial production of panels of 80 and 102 inches, expected by 1H05.

CES 2005
The company showed their large plasma displays in the 80 and 102 inches range:

80” HPR8072 $39000 (also quoted informally as $50000 at the CES booth), TTM May 05, 1920x1080p, 68.7 billion color display capability, 12-bit video processing, integrated w/ATSC and QAM Cable CARD tuners, DNIe, 1500 cd/m2 brightness, 5000:1 CR, DNIe, Anynet chip for home networking.

102” Z-102 $80000/$90000 unofficial MSRP estimate, shown as the largest plasma in existence, available in about two years from CES 2005, 1920x1080p

Samsung 80” Plasma HPR8072

Samsung 102” Plasma Z102

And a 50” panel:
50” HPR5072 $7000, TTM Apr 05, 175 degree viewing

Sanyo
CES 2005
42” PDP-42H2A 1024x1024 monitor, viewing angle 175”, DVI/HDCP, component, RGB VGA D-sub 15 pin

Sony
Jun 04 (company announcement of 2004/5 models)

Plasma XS Series Integrated
Digital Cable Ready, third-generation WEGA engine image processing, TTM Aug 04
37” KDE-37XS955 $5500, 1024x1024
42” KDE-42XS955 $7000, 1024x1024
50” KDE-50XS955 $9000, 1366x768, integrated with QAM Unidirectional CableCARD/ATSC/NTSC tuners, swivel stand included, 100Watt digital amp and 50W subwoofer

Flat Panel Monitor
42” KE-42M1 $5000, TTM Jun 04, 480p EDTV, LSI for contrast improvement

Thomson
May 04 (company announcement of 2004/5 models)

Plasma Flat Panels
Thomson discontinued the plasma line; their supplier (NEC) was acquired by Pioneer. Thomson will concentrate on DLP and LCD.

Toshiba
Jun 04 (company announcement of 2004/5 models)

Cinema series monitor
42” 42HPX84 $6000, TTM Sep 04, HDMI, 1024x768

TheaterWide series monitors

42”	42HP84	$5500, TTM Sep 04, 1024x768
50”	50HP84	$7500, TTM Oct 04, 1024x768

V, Inc

42”	Vizio P2	$3000, TTM current, 480px852, DVI-D, RGB 15-pin, component
42”	P42	$2000, TTM current, 480px852, DVI/HDCP, component, RGB
42”	Vizio P42HD	$2500, TTM current, 1024x768, DVI/HDCP, component, RGB
46”	Vizio P4	$3800, TTM current, 480px852, DVI-D, RGB 15-pin, component
46”	P46	$2500, TTM current, 480px852, DVI-D, component, RGB 15-pin

Vidrikon

Sep 04

Plasmaview monitors

42”	VP-42	$4000, 853x480 EDTV, BNC, compon., DVI/HDCP, RGB 15-pin
42”	VP-42HD	$4000, 1024x768, RGB BNC & 15 pin, component, DVI/HDCP
50”	VP-50	$10000, 1365x768, C BNC & 15 pin, component, DVI/HDCP
60”	VP-60	originally $20000, 1365x768, 3:2 pull-down, anti-burn circuitry

Viewsonic

Jun 04 (InfoComm)

42” VPW4255 $5,500, 1024x1024, 1000:1 CR, 1100 nits, DVI/HDCP, TTM Jul 2004, 160 degrees of viewing angle, RGB, monitor

Sep 04 (CEDIA)

55” VPW5500 $10000, TTM Sep 04, 1366x768, 160 degrees viewing angle

Oct 04

42” VPW450HD AliS, NTSC tuner

CES 2005

42” VPW4200 $3000, TTM Jan 05, 852x480, DVI/HDCP, component, RGB VGA

Yamaha

Sep 04 (CEDIA)

55” PDM-5520 TTM Dec 04, 1366x768, 1000cd/m2 brightness, Fujitsu’s e-AliS technology, 1000:1 CR

LCD-TV Panels

Manufacturers started to compete in the oversized LCD-TV panels market (40" to 65"), as follows:

BenQ	46"	DV4680	$10000, TTM Mar 05, 8ms, ATSC/NTSC tuners
Infocus	40"	TD-40	$7000, TTM now, 1280x768, 600:1 CR, NTSC
JVC	40"	LT-40X776	TTM Jun 05, 1366x768, QAM CableCARD, 2HDMI
	40"	LT-40FH96	TTM fall 05, 1080p, ATSC/QAM CableCARD, HDMI
LG	42"	L42000AT	Integrated; & DU-42LZ30 $8000 also integrated
	55"	RU-55LP10	$TBA, TTM May 05, 1080p, ATSC/QAM/NTSC
LG/Philips	42"	LC420W02	1366x768, 1200:1 CR, 600cd/ brightness
	47"	LC470W01	1920x1080, 1200:1 CR
	55"	LC550W01	1920x1080, 1200:1 CR
Luce/Epoq	40"	HTV-4062	$9000, TTM May 04, dual NTSC tuners
Philips	42"	42PF9830	TTM 2005, Ambilight 2 Series integr. ATSC/QAM
	42"	42PF9996	$11000, monitor
	50"	50PF9966	1000:1 CR, 900cd bright, 1366x768, NTSC, HDMI
Samsung	57"	LNR570D	$16000, TTM Jun 05, 8 ms, ATSC/QAM Cab.CARD
	46"	LNR460D	$9000, TTM Mar 05, LED backlight, ATSC/QAM
	40"	LNR409D	$5000, TTM Mar/May 05, 1080p, 3.2 billion colors
SharpAQUOS	45"	LC-45GD6U	$10000, TTM Aug 04, 1920x1080p, 12 ms
	65"	Model #N/A	$TBA, TTM 2H05, ATSC/QAM CableCARD, 12 ms
Sim2	46"	Model # N/A	$TBA, TTM 2005, now they have the 40"
Sony	46"	KDX-46Q005	$10000-$12000, TTM end 2004, 1920x1080p
Viewsonic	40"	N4050w	$5000, 1280x768, DVI-D, 600:1 CR, 450 nits
Westinghouse	40"	Model #N/A	$2500, 1280x768, integrated
	47"	Model #N/A	$TBA, TTM Mar 05, art frames, 1920x1080p

Audiovox
Mar 04
New LCD panel was introduced
30" AR3000 $3500, TTM 2Q04, 1280x768, one NTSC tuner, component

BenQ
CES 2005
46" DV4680 $10000, TTM Mar 05, 1920x1080p, 600 cd/m2 brightness, 800:1 CR, 8ms response time, 170 degrees of horizontal and vertical viewing, ATSC/NTSC tuners, Faroudja True Life video enhancement, HD component, DVI/HDCP

Other large models will be released

Hitachi
June 2004 (company announcement of 2004/5 models)

LCD Flat-panel TV Direct-view
32" 32HDL51 $TBA, TTM 4Q04, 768p, two IEEE-1394, two HDMI

HP
Sep 04
30” LC3040N $3000, 1280x768, 16:9 AR, DCDi, Visual Fidelity System (VFS), dual NTSC tuners, DVI-D/HDCP, component, piano black finish, included matching table, optional wall mounting bracket

Also LC2640N 26 “ version for $2700

Infocus
Oct 04
30” TD-30
40” TD-40 $7000, TTM now, 1280x768, 600:1 CR, NTSC/SECAM tuners, DVI-D, RGB 15 pin

JVC
CES 2005
40” LT-40X776 TTM Jun 05, ATSC/QAM CableCARD tuners, 2 HDMI & IEEE1394
40” 40FH96 TTM fall 05, 1080p, dual HDMI, Integrated w/QAM Cable tuner, memory card slot, dual IEEE1394

Other smaller LCD-TVs were announced from 17” to 32” with HDMI, 720-770P resolution

LG
Oct 04
42” L42000AT integrated
LCD TVs integrated no-CableCARD
42” DU-42LZ30 $8000
37”
30”

CES 2005
23” RU-23LG10P TTM 2Q05, $ TBA, built-in progressive scan DVD player

55” RU-55LP10 TTM May 05, $ TBA, 1080p, integrated ATSC/NTSC/QAM tuners, 550:1 CR, 500cd/m2 brightness, viewing angle 178 degrees, XD engine, 15watts channel audio output

LG/Philips
CES 2005

Widescreen LCD panels using Super-IPS technology to improve viewing angle (178/178), high color saturation and fast response time, 600 cd/m2 brightness

23”	LC230W02	1366x768
26’	LC260W01/2	1280x768 in 15:9 (1) and 1366x768 in 16:9 (2)
32”	LC320W01	1366x768 WXGA, 1200:1 CR
37”	LC370W01	1366x768 WXGA, 1200:1 CR
42”	LC420W02	1366x768 WXGA, 1200:1 CR
47”	LC470W01	1920x1080 WUXGA, 1200:1 CR
55”	LC550W01	1920x1080 WUXGA, 1200:1 CR

Luce/Epoq

Apr 04

Confirmed models below on Sep 04 at CEDIA under Titan Global Commerce banner

Two 30” 1280x768 $4300 and $4500, NTSC tuners, DCDi

30”	HTV-30A1	$4500, TTM current, 1280x768, 450 cd/m2 brightness, 400:1 CR, component, VGA
40”	HTV-40A2	$9,000, TTM May 04, dual NTSC tuners

Mitsubishi

Apr 04 (company announcement of 2004/5 models)

<u>New Lines (five models) of LCD Flat-panel TVs</u>

<u>40 Series</u>

1280x768, PC compatibility, upgradeable, AMVP

22”	LT-2240	$3000, TTM Jun 04
30”	LT-3040	$5000, TTM Apr 04

<u>Medallion LCD Flat-panel Monitor</u>

1280x768, TTM May 04, black bezel cosmetics, Color View picture control

30”	LT-3050	$5300

Moxell Technology

Oct 04

Seven panels ranging from 14” to 42”

30”	HX-303	$2500, HD panel, 1280x768, DVI/HDCP
42”	MH-422SU	$2500, EDTV 852x480, 1000:1 CR, DVI/HDCP, dual NTSC tuners

<u>CES 2005</u>

<u>MAG Innovision</u>

20”	HD-202AT	$650, TTM now, EDTV monitor

<u>Proview line</u>

14”, 17”, and 20” smaller sizes
26” HX-263 $1700, TTM Jan 05, HDTV monitor
30” HX-303 $2000, TTM Jan 05, HDTV monitor

GL line
TTM early 2005
20” GL-220-D $700, TTM Mar 05, EDTV monitor
27” GL-427D $1900, TTM Feb 05, HDTV monitor
30” GL-430D $2200, TTM Feb 05, HDTV monitor

Philips
LCD panel monitors
42” 42PF9996 $11000
50” 50PF9996 1366x768, NTSC, HDMI, 1000:1 CR, 900 cd/m2 brightness

CES 2005
AmbiLight 2 Series Integrated
Rear panel illumination system, TTM 2005, ATSC/QAM Cable CARD tuners, Pixel Plus 2 HD video processing
32”
37”
42” 42PF9830A
50”

Samsung
Jun 04
LCD TV monitor
46” LTP468W $10,000, TTM Jul 04, 1080p, 800:1 CR, 170degrees viewing angle, industry-leading 12 millisecond pixel response time, DVI, dual component, HDMI, 500 candelas brightness

Oct 04
57” There were no comments issued from the company representatives regarding the status of the 57” version anticipated at CES 2004 (57” LTP578W, $TBA, TTM Jun 04, 1080x1920, 1000:1 CR, 600 cd/m2, DNIe, HDMI, DVI)

CES 2005
The 57” 1080p set anticipated one year ago (above) was finally shown as model:

57” LNR570D $16000 (also reported as $18000), TTM Jun 05, 1920x1080, 600 cd/m2 brightness, 6.2 million color capacity, integrated with ATSC/QAM Cable CARD tuners, 1000:1 CR, DNIe, AnyNet home-networking, response time faster than 8 seconds. Note the delay of one year in availability date announcements, and the improvement of response time to 8ms from the 12 ms of the 46” 468W introduced 6 months ago, although I still see lag at the need but is more tolerable than other LCD screens that run at 20ms.

Samsung also showed a new 46" 1080p model:
46" LNR460D $9000 (also reported as $13000), TTM Mar 05, LED backlighting, integrated ATSC/QAM Cable CARD tuners, LED technology with 100000 hours of panel life, less power, less heat, consistent illumination across the panel, 105 percent of the NTSC color gamut

And two new models with FFL (Flat Fluorescent Lamp) technology:
32" LNR328W $3500, TTM Mar 05
40" LNR409D $5000, TTM Mar/May 05, 1080p, 3.2 billion color gradations, same LED life span of 100000 hours

Sharp
LCD AQUOS
45" LC-45GX6U $10,000, TTM Aug 04, 1080p, AVS system included
45" LC-45GD6U Same features of above model except that lacks the AVS system, S-video connections in/out are different, and is heavier because it has the AVS System within the unit.
45" LC-45GD4U Same features as the GD6U except that the cabinet is silver (rather than titanium), and the unit is designed for 120 volts (rather than 120-240 volts as both 6U models above)

And also 37", 32" and 26" GD6U at 1366x768

Sep 04 (CEATEC in Japan)
65" AQUOS shown as the world's largest LCD panel (according to Sharp), planned production at its 6G plant in mid-2005, no firm TTM dates, 1920x1080 resolution, plans to produce LCD TVs of 50" and larger during FY05 (April 05-Mar 06)

CES 2005
Sharp has shown in the US the 65" model above
65" integrated ATSC/QAM Cable CARD tuners, 1920x1080p, Quick Shoot video circuitry for 12 milliseconds response time, HDMI, IEEE1394, DVI-I, TTM 2H05, $TBA.

Also introduced were the following smaller AQUOS LCD panels:
37" 37GD4U $TBA, TTM Mar 05, 1366x768, ATSC/QAM tuner
And 32" and 26" at 1366x768

D7U and D5U Series
1366x768, EPG, HDMI, IEEE1394, DVI-I, DTUs with titanium finish/bottom speakers, D5U with silver finish/side speakers, TTM 1Q05, $TBA
26" LC-26D7U/D5U
32" LC-32D7U/D5U
37" LC-37D7U/D5U

AQUOS panels use Quick Shoot (QS) Circuit for a response time of 16 milliseconds, 45" AQUOS panels at 12 milliseconds.

Sim2
40" HTL40 LINK $12000, TTM Oct 04, 1366x768, 1000:1 CR, 600 cd/m2 brightness, 170 degrees viewing, 60000 hours lamp life, HDMI and DVI w/HDCP, DCDi
A 46" panel is in the plans for 2005

Sony
(Company announcement of 2004/5 models)

Flat Panel Monitors
Large Scale Integrated (LSI) circuitry to improve response rates
23" KLV-23M1 $2300, LCD TV, 1366x768
32" KLV-32M1 $4500, LCD TV, 1366x768

Sep 04
LCD Qualia Triluminos technology
46" KDX-46Q005 $10000 (also reported as $12000), TTM end 2004, 1920x1080, 450 cd/m2 brightness, 170 degree horiz/vertical viewing angle, replaces cold-cathode backlight tubes (which Sony says reproduce 65 to 75% of NTSC color space) with 8 rows of red, blue and green LEDs that render richer color (105% of the color space of NTSC).

Syntax
CES 2005
Olevia line
Super-IPS (super-in-plane-switching) technology, 176 degrees viewing angle, 1200:1 CR, 1366x768, 8 ms response time, 800 cd/m2 brightness, NTSC tuner for split screens, YPbPr and YCbCr 480i, 480p, 720p and 1080i, VGA for PCs, DVI/HDCP

32" LT32HV $2000, TTM Nov 04
37" LT37HV $3000, TTM Dec 04

Thomson
May 04 (company announcement of 2004/5 models)

LCD TV
RCA Line Monitor
26" LCDX2620W $2600, TTM Jun 04, 1280x768, open distribution, DVI/HDCP, component, RGB, NTSC tuner, 600:1 CR, 500 cd/m2 brightness

RCA Scenium Line
NTSC tuning monitors, DVI/HDCP, component, RGB, 500:1 CR, 500 cd/m2 brightness, 170 degrees of vertical/horizontal viewing
27" LCDX2722W $2800, TTM Jun 04, 1280x720
32" LCDX3022W $3800, TTM Jul 04, 1280x768

CES 2005
Introduced seven new LCD-TV 2005 panels, two w/ATSC tuners, some w/built-in DVD players
15", 20", 23", 26", and 32"

Toshiba
(Company announcement of 2004/5 models)

LCD Monitors
DVI or HDMI, Cable clear DNR+ video noise reduction circuitry
EDTV 4:3 LCD Monitors
500:1 CR, component input, 480x640
14" 14DL74 $500, Jun 04
20" 20DL74 $1000, Jun 04
TheaterWide 16:9 LCD Monitors
DVI/HDCP
23" 23HL84 $1800, Aug 04, 1280x768, 500:1 CR
23" 23HLV84 $2000, Aug 04, LCD TV/DVD combi-unit, 1280x768, 500:1 CR
26" 26HL84 $2500, Jun 04, 1366x768
32" 32HL84 $3500, May 04, 1366x768

Cinema Series Flat-panel Monitors
New double-baffle design
32" 32HLX84 $4000, Oct 04, LCD monitor, 1366x768, 800:1 CR

Oct 04 (CEATEC)
TTM in Japan in Nov 04, records HD video to an external LAN HDD as part of a home network, Meta Brain system LSI
37" $6600 (two versions)
32" $5500

Viewsonic
Sep 04
32" Next Vision N3200w $3000, 1280x768, 600:1 CR, 170 degree viewing angle, 18 ms response time

CES 2005
40" N4050w $5000, 1280x768, 600:1 CR, 450 nits of brightness, DVI-D, component
27" N2750w $1200, 1280x768, 600:1 CR, 550 nits of brightness, EDTV and HDTV inputs for 480p/720p/1080i

Westinghouse
CES 2005

37”
42” $2500, 1280x768, integrated
47” 1080p, TTM Mar 05, 1920x1080p, art frames

HDTV Tuners and Tuning DVRs

On May 2004, at the National Cable and Communications Association (NCTA) Motorola and Scientific Atlanta announced their new HD cable boxes with DVR and VOD capability. The Explorer 8300 multi-room cable DVR from Scientific Atlanta would have the capability of connecting with up to three non-DVR STBs using existing home wiring and provide image control (FF, RW, etc) from all the STBs and IPG, VOD, and PPV content.

Motorola unveiled their DCT6412 HD cable box/DVR/modem for a network environment, using IP-over-coaxial developed by Entropic. The DVR system could stream out up to four HD recorded programs simultaneously and control recording functions from other rooms. Similar features have started to be downloaded as software upgrades on the DCT6208.

On August 2004, LG announced that the company expects DTV ATSC STBs that would down-convert the digital signal and connect via RF or base to analog TVs to be retailing between $50 and $70 by 2008, starting to be under $100 in late 2005. The company also estimates the existence of about 80 million analog TVs that tune to broadcast via antenna, to those the STBs above would offer the option to continue using their analog TVs, which is expected to generate enough demand for the volume to bring the price down to the expected price, although lower licensing fees are also a contributor to the lower price.

On Oct 04, Zenith demo their E-VSB (Enhanced VSB) for reception with multiple moving echoes (car/bus), and MPEG-4, suited better than MPEG-2.

On December 2004, IMS Forecast issued a projection of 90 million HD-STBs to be shipped worldwide by 2009, doubling the 2004 expectation. The region of Asia Pacific is expected to supply about 40 percent of that volume, mainly due to China's aggressive migration to digital transmission in such a large population.

Note: Satellite services companies offer packages that bundle programming services with HD-STBs or even H/DTV sets, packages are not covered in this report.

Dish Network

The following two models (811 and 921) are listed as they appeared on the CES 2004 report, although the 921 is now discontinued:

DISH811

$400, TTM Dec 03, ATSC OTA/satellite tuners (one each) DVI/HDCP, NO 1394, component out, NO RGB out, replaces Dish 6000, NO PVR, tuner module included inside the unit, same selectable outputs of model 921, converts formats to any output, 2 days of electronic program guide, optical digital audio out.

PVR 921 *(Innovations CES 2003 best of show winner), $1,000, original TTM was for 2Q03 (actual TTM was Dec 03), although the unit has been announced as ready to release for almost 2 years. HD-PVR with a 250 GB HDD, up to 180 hrs SD, up to 25 hrs HD, one DVI-I/HDCP, two 1394/DTCP to be enabled via*

future software upgrade, dual satellite tuners, ATSC OTA tuner built in, one component out, 2 USB ports for future use (such as remote keyboard), records DD when available and over the air digital broadcasts, headphone and USB jacks in front panel, records up to two programs in the PVR simultaneously (HD or any) while capable to play another HD program stored in the PVR (or from the 3rd HD tuner).

Nine days electronic program guide, optical digital audio out, 30-second skip for commercials, four fast-forward and fast-rewind speeds, picture-in-picture, multi-device remote control, selectable output from the menu for 480p/720p/1080i, stores signal in original resolution. Some users reported that the HDD is always turning. Beta testing reports are available on the Web.

The PVR921 was actually introduced by mid 04, is now discontinued, and it is currently been offered for $549.

CES 2005

Dish Player DVR942 ($700 + $50 dish, TTM Feb 05), 250GB DVR for up to 25hrs HD, or 180 hrs SD, dual tuner satellite receiver with 2 TV outputs for multi-room viewing, up to 9 days EPG, records DD, ATSC tuner and records OTA, caller ID with history, 2 USB ports for future use, optical audio out, DVI/HDCP, component YPbPr, planned to be offered also for lease with a $250 initiation fee (and the subscriber is expected to return the box at the end of the service).

A couple of portable DVRs were also displayed at CES 2005 that store content transferred from the DVR942, once stored into the portable unit the content can not be outputted (other than playing back or erasing it, by the subscriber). Screen sizes are 2.2, 4, and 7-inch screens, capacity of 20GB and 40GB, some accept Compact Flash cards, have IEEE1394, and USB 2.0 to receive the content.

DirecTV

The units shown below were part of Hughes inventory before they were acquired, and still current, the text is sourced from the CES 2004 report:

Hughes

HTL-HD *$500, TTM Nov 03 (unit apparently offered for $99 temporarily by DirecTV), ATSC and DirecTV tuners, similar to HD300 from Sony and 3200A from LG, but IR remote, DVI, component, optical digital audio (no coaxial), VGA D-sub 15 in, switch in back for DVI/VGA, DVI cable, 720p/1080i switch (front button on box)*

New HD-DVR250 *$1,000, TTM Apr 04, w/HD Tivo, Best of Innovations CES 2004 2 ATSC + 2 DirecTV tuners (E* 921 HD-STB has only 3 tuners in total), HDMI/HDCP, component, 2 sat RF inputs, digital audio Toslink, 2 USB ports (for future use), 1 RF antenna that splits internally to two ATSC tuners, 250 GB DVR for up 30 hrs of HD*

recording or up to 200 hrs of SD recording, built-in fan, S-video out.

Pause live TV up to 30 minutes, DirecTV advanced program guide w/14 in advance (most PPV 24hrs in advance), multiple screen formats (standard, letterbox, panorama).

Selectable output for 480i/p, 720p, or 1080i (reportedly via soft button). Functionality to been able to pause, instant replay, rewind live TV and fast forward and playback recorded programs in normal speed, slow motion or frame by frame.

Can record two different programs from either DirecTV, ATSC or one from each, as well as watch a pre-recorded program at the same time. It records one HD program while watching another (requires connection of two satellite inputs from a triple LNB dish antenna). Simultaneous SD and HD output not specified (and assumed as NO). According to DirecTV, there are NO plans for a future 1394 output.

CES 2005
DirecTV is working on a new Home Media Center DVR that will connect to clients around a house network, the center is initially for SD services only (demo at CES) but it is expected that a similar unit with HD capabilities will follow in late 2005, most possibly in 2006. Such unit would probably be the one to replace the current 250-DVR when switching to MPEG-4 later in 2005.

HP
Digital Entertainment Center (DEC) STB with MS Media Center Edition 2005 for photos, music, video, FM tuner, HDTV tuner, and PVR, all in one box

Model z540 $1500, TTM Oct 04, single analog TV tuner, 160 GB HDD
Model z545-b $2000, two tuners, 200GB HDD, removable 160GB Personal Media Drive via USB2 to transport multimedia file anywhere and expandability

Extender unit $300, to make a regular TV a Media Center client by pulling content that resides in the DEC center via a wireless or Ethernet cable connection, with a maximum of five clients.

JVC
As appeared on the CES 2004 report:

TU-DVR921RU $1,000, TTM Dec 03
JVC unit that pairs the Dish Network 921, 250 GB HDD, Dish Wire 1394 A/V connectors to use with select products, ATSC and NTSC tuners, DVI/HDCP, dual E tuner 480i/p/720p/1080i outputs, DVR capacity for up to 180 hrs of SD or 25 hrs of HD, or a combination of both.*

The sibling PVR921 unit from Dish Network was actually introduced by mid 04, and is now discontinued.

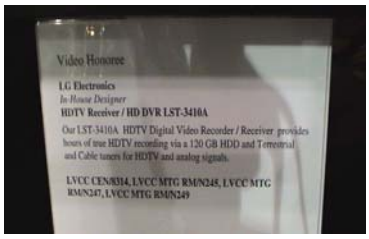
CES 2005
TUDP811 current model, check details on 2004 report

TUDVR942 Sibling of the DVR942 DVR Dish Network STB mentioned above

LG / Zenith
Jun 04
LST-3410A DVR – update in price $650 (from $1000), discontinued units are offered at Best Buy $550 (Dec 04).

The following is the detail of the available units from when the units when introduced (as appeared in the CES 2004 report):

LG LST-3410A



(Previously announced as Zenith HD-PVR330), $1000, TTM Feb 04 (originally Nov 03), ATSC, QAM tuners, PVR 120GB, 8 hrs HD recording, DD recording, DVI/HDCP, RGB, component, 1394 2way, GemStar EPG, No CableCARD for scrambled cable channels

LG LST-3510A (previously announced as Zenith HDX330), $500, TTM 4Q03, ATSC/QAM/NTSC tuners, DVD player, 3:2 pull-down, 5.1 DD audio, simultaneous HD and SD outputs, DVI/HDCP, RGB, component, DVD upconversion to 1080i over DVI, selectable 1080i, 720p, 480i/p outputs, line-doubler. Originally excluded IEEE1394 (when from Zenith), LG version excluded IEEE1394 as well.

CES 2005
LST-4200A ATSC/NTSC/QAM unscrambled tuners, DVI/HDCP, PSIP, simultaneous 480i output, component, RGB

Mitsubishi
Apr 04 (company announcement of 2004/5 models)

New HDTV Receiver/Controller

HD-6000 TTM later 04 at selected retailers, HD 120GB PVR (personal video recorder), up to 12 hours of HD recording, and 72 hours of non-HD, subscription free, MPEG SD encoder, AMVP2(TM) Mitsubishi's second-generation Advanced Multimedia Video Processor.

ATSC/QAM CableCARD/NTSC tuners, NetCommand(R) 4.0 system control, PerfectColor(TM) 6-way color adjustment, TV Guide On Screen(R) electronic program

guide, seven inputs including one HDMI, and three component video inputs. Outputs include one HDMI, and one component video. Two FireWire(R) IEEE 1394 digital home-networking ports.

The analysis I provided in the CES 2004 report (below) for the predecessor unit of the above model (the HD-5000 Network Controller – Promise set top for $1700) still applies to the newer model regarding digital connectivity to legacy TVs, the text was as follows:

This unit (HD-5000 Network Controller) facilitates early HDTV monitors with home networking capability and digital recorders connectivity even though their TVs lack digital interface connections, however, it does not provide those early HDTV monitors with the full digital connectivity available on newer DVI HDTVs, as follows.

The controller does NOT have a DVI input, which means that the solution offered by this unit as the promise for a " customer who wants all of the features and convenience of a top-of-the-line integrated HDTV" (as stated on the web-site), would not actually be met for DirecTV subscribers.

A subscriber of DirecTV, which STBs only use a DVI output as digital connection, who is also the owner of an earlier non-DVI HDTV model, could not use this Promise set-top-box to get the full benefit of the meaning of the "digital-connectivity promise", when the controller is not able to receive the digital signal of the DVI output of the DirecTV STB, so it can be send to the HDTV for viewing when the content is protected with HDCP.

This leaves the traditional component analog connection as the only choice available for this owner of a $1700 promise box. Such viewer of protected content could be subjected to possible copyright HD viewing restrictions when the content is sent via the component analog connection, if/when those restrictions are implemented.

Motorola

For current models of the 6200 QAM Cable STBs family and the BMC9012/22 Media Centers STBs, please consult details and photographs included in the CES 2004 report.

CES 2005

The company showed the following HD units:

Model 6412

VOOM 550 and 580 models include below with Voom STBs

MOXI BMC9022 server, dual tuner networked 160GB DVR (records two cable programs, watch one of them), Docsis modem for interactivity and VOD, integrated DVD/CD player, NO ATSC tuner

MOXI MATE (client box for the above) suited with only L/R/V and RF output connections for remote TVs

Motorola informally declared that they have discontinued the ATSC tuner HDT100, the ATSC/QAM tuner HDT300, and the 160GB DVR ATSC/QAM tuner, all three HD-STBs the company introduced at CES 2004 one year ago. Apparently, there was no market interest for those products. Details and photographs can be obtained at the CES 2004 report.

Norcent
ZAT-500HD HD-STB w/ATSC OTA tuner, shown as prototype at CES 2005, TTM N/A, $ N/A

RCA
Current models as detailed on the CES 2004 report:

ATSC10 $549, ATSC only, TTM 1Q03, RGBHV on 15-pin D-sub, HD component out, DVI/HDCP, NO 1394, coaxial and TosLink DD audio out, output resolution switchable to 1080i and 720p

ATSC11 $449, TTM summer 03, ATSC tuner only, no NTSC tuner
ATSC21 $499,TTM summer 03 (was still unreleased by Nov 03), ATSC/NTSC tuners, $50 extra for NTSC tuner over the model ATSC11
As per Press Release May 22, 03, both units above were reported to have DVI, 1080i/720p/480p/I output, simultaneous 480i, audio optical/coaxial outputs, component, RGB 15 pin D-sub adapter (unconfirmed)

DVR10 PVR $449, TTM Summer 03, 80GB HDD, enough for 9 hrs of HDTV recording or 40 hrs SD, when connected to any two-way IEEE 1394 device such as the new line of RCA and RCA Scenium HDTV Sets, the RCA DVR10 can record and store HDTV.

Dish Network HD satellite STB
HD6000 $492, TTM current, component, RGB, optical digital audio

(Announced at CEDIA Sep 03)
DTC-210 $600 (offered for preorder at $529), TTM 1Q04, DirecTV and ATSC tuner, DVI/HDCP, multiple output formats 1080i, 720p, 480p/i, component and 15 pin D-sub, simultaneous 480i, coaxial/optical DD audio outputs, integrated electronic guide

Samsung
Mar 04
SIR-TS360 DirecTV HD receiver, ATSC/NTSC tuners, 1080i/720p/480p/I selectable outputs, simultaneous 480i/HD outputs

SIR-T351 HDTV tuner

Jul 04 (2004 Samsung Line Show), $350, TTM Aug 04
ATSC/QAM cable on-the-clear, 1080i/720p/480p/I selectable outputs, simultaneous 480i/HD outputs, DVI, component, optical/coax dig audio connections

SIR-S4080R DirecTV HD-STB tuner DVR, 80GB HDD, TTM Aug 04, 70 hrs of recording (SD), record two shows at the same time or watch one while recording another, pause live TV up to 30 minutes, up to 14 day advance program guide, optical digital audio out, dual USB 1.1

On June 2004, Samsung communicated their plan for their STBs to comply with the FCC mandate of Broadcast Flag. The company informed that the FCC ruling would affect devices sold after July 1, 2005 as well as previous models, for which an upgrade will be needed, otherwise "Failure to upgrade your receiver with the broadcast flag standard may prevent you from fully experiencing DTV since you will not be able too receive protected content and may interfere with unprotected content as well; if the Broadcast Flag is broadcast the Samsung set top box could turn off and cycle on-off and nothing will be displayed until the upgrade is performed. If you are a DirecTV customer the upgrade will be handled automatically by DirecTV through your Satellite connection".

Instructions were provided to upgrade the following models: PRL-3100, SIR-T151, SIR-T165, SIR-TS160 (without DIRECTV activation), which could be obtained from Samsung's Website at www.samsungusa.com/broadcastflag

CES 2005
Samsung showed several models for OTA, Cable, and DirecTV:

DirecTV model that DirecTV distributes:
H10 HD/SD DirecTV / ATSC tuners, HDMI, component, optical/coax dig outputs

Open Cable HD STB with OCAP
DCB-A800C TTM 2Q05, ATSC/QAM Cable CARD tuners (dual each), OCAP 1.0 middleware, DVI, component, RGB, digital audio optical, 10/100Base T Ethernet, IEEE1394

Home AV Server Multi- Room Network
160GB HDD DVR, ATSC/QAM tuners, DVD player, Internet access, content sharing with clients, DVI, component, RGB, optical/coaxial digital audio connections, USB 1.1, 10/100 Base T Ethernet, V.90 PSTN Modem, Ucentric middleware

MovieBeam Terrestrial VOD Movie Service and STB
MTR-1120U ATSC & NTSC tuners, VOD service receiver, storage capacity up to 100 movies, 10 movies updated every week, 160 GB HDD, CAS: Nagravision,

digital audio optical out, USB 1.1, V.90 PSTN modem, service of VOD only in 3 cities by Buena Vista

Scientific Atlanta
The following are the current models as detailed in the CES 2004 report:

3250HD *$500 (as of Sep 03), rented by cable company, TTM 4Q02, DVI (was not activated as of Sep 03), 1394 optional, component out, RGB adapter, selectable video resolution, USB port, AR control, coaxial digital audio out*

3270HD *$500, TTM fall 03, 3rd generation STB, 64 and 256 QAM with a single tuner, two 1394, component and DVI 1.0 included, initially available at Best Buy, 720p/1080i, also by Cox cable, simultaneous HD with 480i for VCR, shows guide while smaller scaled window of current program could still show small letters, zoom and stretch functions from unit and remote. Sale version of the 3250D.*

Explorer 8000HD *Home Entertainment Center*
Initially sold directly to cable operators, later available to retail distribution, dual 1394, PVR with several HDD options, DVI, component out, RGB adapter, selectable video resolution, optical digital audio out, USB port, AR control, in June 03 the unit was being tested by Cox, 1394 initially one way only, a firmware needs to be delivered to activate the STBs that have 1394 connections, voice over IP cable modem to facilitate voice/data/video.

Explorer 8300 *TTM 3Q04, Multi-room system, mock-up shown at CES 2004, built upon the 8000HD model, PVR with USB for external additions of HDDs, up to 3 client STBs could be connected coaxially to this server, the clients could also be any older cable STB that the company could recycle back as a slave unit of the server (like the model 2100), each client could control one independent DVR session, and watch a different program with full forward, pause, etc. controls.*

CES 2005
Scientific Atlanta showed a new DVR model (# pending) expected for end-2005 that is able to write HD into a Hi Def DVD recorder incorporated into the unit.

The HD-STB is a QAM Cable DVR and the DVD media in HD is stored as a file copy format, the Hi Def DVD disc is playable only on the recording STB (or another STB of the same model), the DVD unit also records DVD-R/-RW that could be playable on other DVD players if CPRM permits it. The STB will be made available to Cable companies only.

The model will have IEEE1394, 160GB DVR, records 8.5 GB on dual layer DVD, and will be a server piece connected to a home network via coax to other

existing Scientific Atlanta STBs. The company is still working in incorporating a Cable CARD slot into the HD-STB, which was missing at the CES demo.

Sharp

CES 2005

Sharp showed two DVD-RW/-R HDD recorders

DV-HRD200 400GB HDD for up to 34 hours of HD (or 390 hours of SD), HDD/DVD two way dubbing, DVD-RW/-R recording, iLink interface, triple digital tuner (terrestrial, BS and CS110) for Japan domestic DTV, enhanced DVD playback, compatibility with DVD+-RW and +-R

DV-HRD20 250GB HDD for up to 21 hours of HD (or 314 hours of SD), DVD-RW/-R recording, HDDD-DVD 2 way dubbing, iLink, triple digital tuners (terrestrial, BS/CS110) for Japan domestic DTV, enhanced DVD playback, compatibility with DVD+-RW and +-R

Sony

Sony still mentioned the SAT-HD300 HD-STB at CES 2005. Details included in the CES 2004 report.

In 2004, the company announced the following 2004/5 models:

HD QAM Cable STBs with DVR

On Sony's press release of February 04, the company announced the future introduction (by fall 04) of two new Cable HD-STBs with DVR capabilities, featuring ATSC/NTSC/QAM CableCARD tuners implementing Sony Passage integrated decryption technology. The boxes were said to be suited with HDMI/HDCP, Gemstar integrated EPG, component output, flexible AR settings, DD 5.1 w/optical audio out, USB data ports, and memory stick for JPEG and MPEG1, as follows:

DHG-HDD100 $700, TTM fall 04, 120GB HDD, 120 hours SD, 12 hours HD
DHG-HDD200 $800, TTM fall 04, 250GB HDD, 200 hours SD, 25 hours HD

However, later, in August 04, Sony issued a different press release announcing the future introduction of other models, as follows:

DHG-HDD250 $800, TTM fall 04, 250GB HDD, 20 hours of HD recording
DHG-HDD500 $1000, TTM fall 04, 500GB HDD (two 250GB HDDs), 60 hours of HD

At CES 2005, Sony has confirmed that they decided to replace the two original models (100 and 200) even before they were expected to appear in fall 04.

It is important to note that these HD-STBs have a connectivity limitation: they lack IEEE1394 Firewire ™ input/outputs. This means that a tuned/stored HD content would not be able to be output to a D-VHS recorder for HD tape archival, nor it could be part of digital networking of compressed HD video with other devices or displays.

Additionally, such limitation does not comply with a specification requiring 1394 digital connectivity on Cable HD-STBs established in the plug-and-play agreement made by the Cable and Consumer Electronics industry, and approved by

the FCC. If you are interested in more details, this subject was covered on my article "HDTV Integrated Tuners and You" that appeared on the second issue of the HDTVetc magazine.

Thomson

Jan05

The company announced a new HD STB that will be released early 2005 for $300 to send HD video (MPEG-2, MPEG-4, XviD, WMV9) from a PC running XP or Windows 2000 (Mac OS X for 2Q05) to a TV using wireless technology, the STB is the Acoustic Research Digital Media Bridge receiver. It is capable of also send pictures and audio (MP3, WMA, WAV) to units that support Universal Plug and Play (UPnP) in the wireless network. The system can also send CinemaView movies (5000 in inventory) downloaded from the Internet service. Content can be send from up to 3 PCs with Implicit Networks server software to a HDTV within the network. The receiver has DVI.

USDTV

OTA STB for their broadcast service and ATSC, component, optical audio out, USB, NO IEEE1394, TTM now, $200, or lease option of $20 initial fee and $20 x 12 months, and the STB is yours after that. Plans for future DVR are being discussed.

Viewsonic

On March 2004 Viewsonic announced the April availability of their new NextVision HD10 HDTV OTA and NTSC tuner, with component outputs and aspect ratio control, outputs 480i/0, 720p and 1080i, MSRP $400.

On September 2004 Viewsonic announced the model HD12 HD-STB, TTM Oct 04, $400, OTA ATSC/NTSC tuners, DVI/HDCP, HD component, VGA RGB.

V, Inc

Current model. As appeared in the CES 2004 report:

Bravo HD1 $350, TTM Feb 04, ATSC/NTSC tuners, scale to 480p/720p/1080i over component output, component, digital audio coax, titanium finish, NO DVI, NO 1394, NO VGA 15 D-sub outputs, aspect ratio control (4:3, 1:6 letterbox, 16:9 full), simultaneous SD and HD outputs

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Voom

Regarding HD-STBs, Voom still have their Motorola 550 and has not yet released the 580, both included on the CES 2004 report.

On a 2004 review of their STB, it was noted that if the service is discontinued the OTA tuner will no longer function. Changing channels was very slow (7 seconds to lock into video/audio). Voom is working on 4 to 5 seconds, still about twice DirecTV and E*. Movies wider than 16x9 are panned and scanned to fill a 16x9

screen; VOOM is reexamining the policy. VOOM does not have yet quality standards for its movie transfers.

Additional detail about the 580 model is below:

Developed by Motorola, channel oriented recording DVR with clients, TTM Mar 05 but without network capabilities until later, which will be upgrade it by software download, $N/A (although a year ago the company estimated the price to be competitive with the other DVR STBs), 250GB of HDD, client STBs will not be available immediately upon its release but later in summer of 2005, current Model 550 HD-STBs could perform as clients and will be able to see the menu of the 580 DVR server, upgrade path for existing customers is being discussed but no commitments were made.

MPEG-4 upgrade will be performed at field by inserting custom available modules (MPEG-4 card on the side door) when available. Future improvements (MPEG-4 algorithm enhancements) can be downloaded via satellite.

The 580 has DVI and component YPbPr video HD outs, supports 1080i/720p/480p/480i resolution formats, tunes HD OTA with internal ATSC tuner, and has optical digital audio out, similar to the model 550, neither unit, as well as the thin future network client boxes, will have IEEE1394 outputs for D-VHS tape archival recording (at the CES 2004 Voom declared that the 580 would have IEEE1394).

For more details regarding how the plans of these units evolved within the last year please consult the section of HD-STBs for VOOM in page 81 of the CES 2004 report.

The 550 originally offered as $750 when released in 4Q03 is now offered for $499 and includes the ATSC antenna/dish and installation.

High Definition DVD

The complete review of the State of the High Definition DVD Technology has been covered in an article I recently wrote for the HDTVetc magazine, please consult **www.hdtvetc.com** for access to that information, they also have an online service. This section addresses the main aspects of the technology and the CES 2005 highlights.

Formats Support

A variety of Hollywood Studios took sides on the war between Blu-ray and HD DVD formats, although the sides are non-exclusive; the Studios can still produce High Definition DVDs on the other format at their discretion.

Studio MGM and Sony Pictures/Columbia Tri-Star were already committed to Blu-ray, and will begin releasing Blu-ray movies with their DVD releases when Blu-ray players become available within the US in late 2005/early 2006, but during 2004 several events took place to support the Blu-ray format, Twentieth Century Fox announced their support to Blu-ray to become involved in the development of the format and the copy protection features; Fox favored Blu-ray but was not ready to commit their content yet, and continued exploring HD DVD through the DVD Forum.

In addition, Disney became a member of the board of directors of the Blu-ray Association and decided to support Blu-ray (bringing Buena Vista Home Entertainment, Walt Disney Home Entertainment, Hollywood Pictures Home Video, Touchstone Home Entertainment, Miramax Home Entertainment, Dimension Home Video, and Disney DVD to the commitment). TDK joined Blu-ray and announced their effort to implement a new hard-coat technology to make the disc caddy-less. JVC also joined Blu-ray.

Blu-ray is now supported by over 70 companies; the Blu-ray Disc Founders recently formed the Blu-ray Disc Association and a group to collect royalties and licensing fees. The following 13 companies were the original Blu-ray Disc Founders group: Dell, Hewlett-Packard, Hitachi, LG Electronics, Matsushita Electric Industrial, Mitsubishi Electric, Pioneer, Royal Philips Electronics, Samsung Electronics, Sharp, Sony, TDK, and Thomson Multimedia.

The HD DVD format is promoted by Toshiba and NEC, and was recently joined by Sanyo. Studios like Paramount Pictures, Universal Studios, Warner Bros., and New Line Cinema declared their support to HD DVD and will release films by the end of 2005. Thomson/RCA announced their plans to release a HD-DVD player before December 2005 as a sign of support to those Hollywood Studios that use the disc replication services of the Thomson Technicolor unit, which Thomson intends to extend to Blu-ray discs as well.

Beginning 4Q05 Warner Home Video will release over 50 titles in the HD DVD format from HBO video, New Line, and WHV. HBO will release three series, and New Line Home Entertainment four titles. Paramount will release 20 HD DVD titles and Universal 3 titles, also beginning 4Q05.

Formats Specs, Audio, Codecs, Content Protection, and Cameras

Regarding specifications, the DVD forum approved the 1.0 ROM HD DVD specification and later the specifications for the Rewritable –RW format, as well as the write–once HD DVD recordable specification version 0.9, which as planned for completion by the end of 2004. The Blu-ray disc ROM specification was declared as ready in 2004, which would facilitate the preparations for the production of the discs.

The Blu-ray disc has a capacity of 50GB as dual-layer, and is constructed with a 0.1 mm optical transmittance protection layer above the 1.1 mm substrate. Matsushita has a 50GB LM-BRM50 rewritable disc with an approximate cost of $68, and a 25GB LM-BRM25 disc for about $31.

HD DVD uses the same two 0.6 millimeter bonded discs design as DVD, has a dual-layer capacity of 30GB for up to 8 hours of HD, and claims compatibility with the current infrastructure of producing regular DVDs, which would bring more efficiency and less upfront investment.

Both groups/formats selected MPEG-2, MPEG-4 H.264, and VC-1 (originally known as Microsoft's WMV-9 and VC-9) as mandatory video codecs for players; discs would have to be encoded in at least one of them. VC-1 is now an open standard and was voted by 19 companies from the DVD Forum steering committee as best in picture quality. According to Microsoft, the company will remain neutral regarding format support.

Regarding content protection, an alliance of Consumer Electronics (Sony, Toshiba, Panasonic, etc.), IT companies (IBM, Microsoft, Intel, etc.), and Hollywood Studios (Disney, Warner, etc), was working in the development of AACS (Advanced Access Content System) expected for release by the end of 2004. AACS employs a key required by the hardware and software to unlock the content.

HD DVD and Blu-ray groups approved Dolby Digital 5.1 and DTS 5.1 as mandatory for HD players; pre-recorded discs must include at least one of the formats, at the election of the content provider. Later, the DVD Forum decided to include also Dolby Digital + (a higher bit-rate enhancement of lossy AC-3) and MLP lossless, both as mandatory for HD DVD. The groups declared optional the player's ability of decoding 6.1 channels DTS ++ (DTS HD, capable of higher bit rates). Both types of discs could support up to 18Mbps, which HDMI could pass through, according to Silicon Image. HD players suited with internal hi-bit-rate decoders could also use the 6.1 or 7.1 analog outputs connected to receivers with 6.1 or 7.1 channel analog inputs.

As to how this industry affected video cameras, Sony, Sharp, and Panasonic announced their plans for Blu-ray camcorders that will use 3" 15GB discs; the units are expected for early 2005.

Enhanced Discs and Drives Technologies

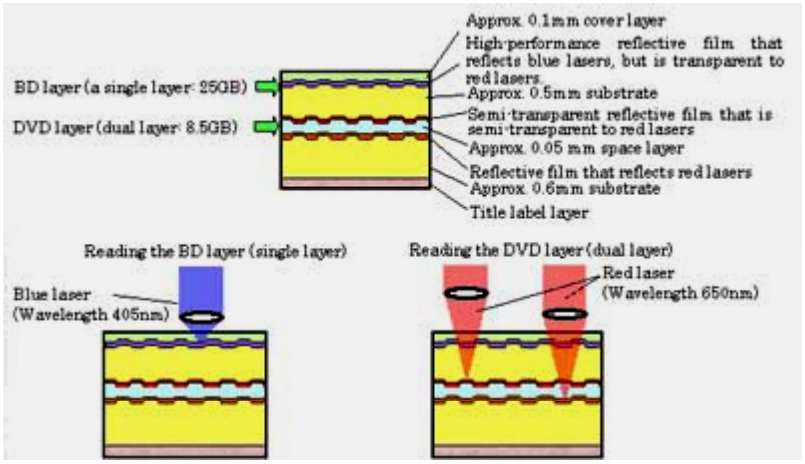
Several companies announced enhanced HD products such as combo discs and high capacity HD discs. NEC just announced a computer disc drive for HD-DVDs also compatible with current DVDs and CDs.

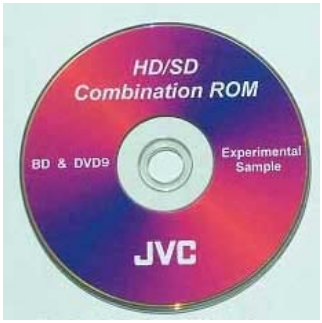
New Medium Enterprises announced their 4-layer Versatile Multilayer Disc (VMD) drive/disc of 20GB using red laser technology to show HD films in MPEG-2 1080i/p formats; in fall 2005 other 15GB, 20GB, 25GB and 30GB discs and drives options will be available, and 50GB later in 2006. VMD players are estimated that will be $250 and are DVD/CD compatible, and although VMD discs are scientifically different they can be produced with the existing DVD facilities at a similar cost. Recordable capabilities require minor modifications of the technology. A blue-laser version for one-Terabyte is in the works.

As you might recall in my CES 2003 report, two years ago Philips announced HD-DVD backward compatibility implementing two video streams on the disc: a) SD video with MPEG-2 to be played back in regular DVD players, and b) a 'difference' stream encoded as MPEG-4 and carrying the difference between the original HD picture signal and the base SD signal that newer HD players with MPEG-4/10 decoding would read; using the two streams they can reconstruct the HD signal.

Later Pixonics introduced a similar concept on their pHD format using red laser for HD DVD, which was also targeted to more efficient broadcasting, and delivery systems. The disc capacity of 3.5 hours of combined streams, SD at 6Mbps with MPEG-2 and the additional 1.5 Mbps HD content, was reachable using a 9GB dual layer DVD disc, which would enable the disc to deliver up to 1080p. pHD SD MPEG-2 signals would use the current CSS content protection scheme, although more Digital Rights Management methods were considered for the enhanced HD stream.

By the end of 2004, JVC announced the first Blu-ray/DVD ROM triple-layer disc to hold HD in the outer layer and SD





content in the inner two layers, with 33.5 GB capacity in a single side (25 GB HD + 8.5 GB DVD); a blue laser reads the outer BD layer; a red laser reads the SD layer. Movies can be released in both formats on a single disc. The reflective film technology uses a double-faced substrate molding able to reflect blue laser and be sufficiently transparent so the red laser could read the inner layers. A higher capacity version of 58.5 GB (50GB for the Blu-ray "dual" layer, 8.5GB DVD dual layer) is on the works.

On a similar approach, Toshiba and disc maker Memory-Tech recently introduced a dual-layer disc capable of 4.7 GB DVD content in an upper layer and 15GD HD DVD content in the lower layer, intended to help the transition from DVD to HD DVD since it will contain both versions of a movie.

With the introductions from JVC and Toshiba movie buyers will save when purchasing a combo disc, play it as SD on today's DVD players, and later play it as HD in their future HD DVD player. Production costs and manufacturing are similar to DVD; studios and distribution chains would also be benefited when not dealing with two versions of the same movie.

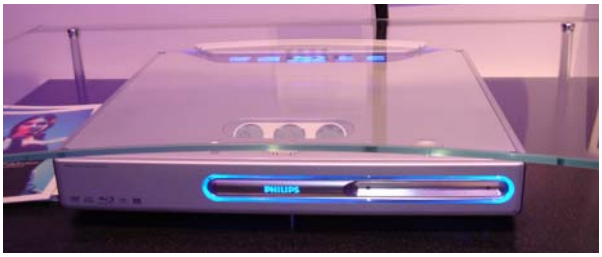
High Definition DVD at CES 2005

JVC submitted for approval to the Blu-ray Disc Association the adoption of the combo system above and has shown the unit below at CES:

JVC Blu-ray DVD Combo ROM

LG showed the BH-6900 (below), currently available in Korea for $4000, a Blu-ray recorder with ATSC/NTSC tuners, 160GB HDD, 16 hours of HD, 156 of SD, BD to HDD two-way dubbing, 23 GB Blu-ray disc for up to 2.5 hours of HD programming, multiple disc playback for DVD, DVD-R, DVD+R, Audio CD, PSIP, IEEE1394 (DVi iLink for camcorders), component and DVI output, TTM after 2005.

Panasonic showed a Blu-ray BD-ROM player prototype (right) and a BD-ROM player concept, $N/A, TTM N/A; the company also showed the DMR-E700BD (left), a BD/DVR recorder released in Japan in July 2004, $2800, digital OTA tuner, 4.5 hours of HD with 50GB dual layer open-cartridge discs, DVD-RAM and DVD-R discs recording for analog TV, dual-drives manufacturing plans of 2000 units x month.



Phillips showed a Blu-ray recorder (left) and a PC drive recorder unit that will also play ROM BD discs, TTM 2005, $450. No decisions were made yet regarding 1080p playing/recording, neither on 1080i over component analog video for the US.

Pioneer will introduce a PC Blu-ray (2H05), and later a Blu-ray recorder (right) that was demo at the show (DVD/BRD), both able to record HDTV, SDTV, DVD-R/-RW, and DVD+R/+RW discs.

Samsung also showed model BD-P1000 Blu-ray ROM player (left), $1,000,

TTM end of 2005, and (below) recorder player model BD-R1000, TTM N/A, $ N/A, Samsung did not confirm if ROM BD discs will play in the recorder US

unit; first demo last year with ATSC/NTSC tuners, HDMI, component out, digital audio coax/optical, selectable outputs switchable to 1080i/720p/480p, estimated originally at $2000 but not released. Samsung Blu-ray BD-R1000 Recorder/Player

Sanyo joined the HD DVD format and showed a prototype HD DVD ROM player, TTM end of 2005, $1000.

Sharp showed Japan's Blu-ray recorder BD-HD100 (right), DVD-RW/R recorder, 160 GB HDD for 19 hours of HD or 218 hrs of SD, twin-tray for Blu-ray and DVD allowing copying of unprotected content between the discs and the HDD, 6-way digital dubbing (Blu-ray, HDD, DVD) DVD multi format playback (DVD-RW/-R and +RW/+R and RAM), HDMI, i.Link, triple digital tuners (terrestrial and satellite), TTM December 2004, $3,000, records/playbacks 25GB single layer discs but reportedly not dual layer 50GB discs, playback DVD, DVD+/-R, DVD+/-RW, DVD-RAM, and CDs, production plans for 3000 units x month.

Sharp BD-HD100 Blu-ray recorder

Sony showed two Blu-ray players using MPEG-2 and VC-1 codecs (below), and the recorder/player available in Japan since April 2003:

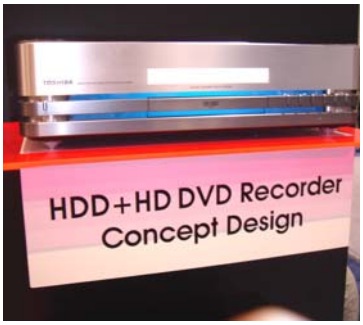
SONY Blu-ray Player MPEG-2

SONY Blu-ray Player VC1


SONY Blu-ray Recorder BDZ-S77

Sony also showed the model # BDZ-S77 available in Japan since April 2003 (left), originally $4,000 now around $3,000, disc with caddy, single-layer 23 GB capacity discs, Sony discs playable/recordable in the Matsushita unit, Panasonic 25GB discs play after 90 seconds recognition, 50GB Matsushita discs cannot be used, single drive w/ two laser heads (red/blue).

Toshiba announced blue-laser players ($1000), recorders, and discs that will appear in late 2005, including the notebook built-in drives. They are capable to play regular DVDs and CDs, with HDMI/HDCP and IEEE1394/DTCP outputs, Ethernet interactive connection, support video resolutions up to 1920x1080p, if discs are recorded that way, selectable to match the native resolution of the display; 1080p output resolution is not yet confirmed, nor if 1080i HD playback would be allowed over analog component outputs. Like most DVD players with that feature, DVD 1080i upconversion of protected content is over HDMI only.



Meetings were held at CES to discuss the possibility of reaching an agreement in avoiding a format war, no agreement was reached, but Sony was quoted as looking into having their Blu-ray unit capable to play HD-DVD as well, no official announcements were made.

In addition to the format war above, there is the Chinese EVD format.

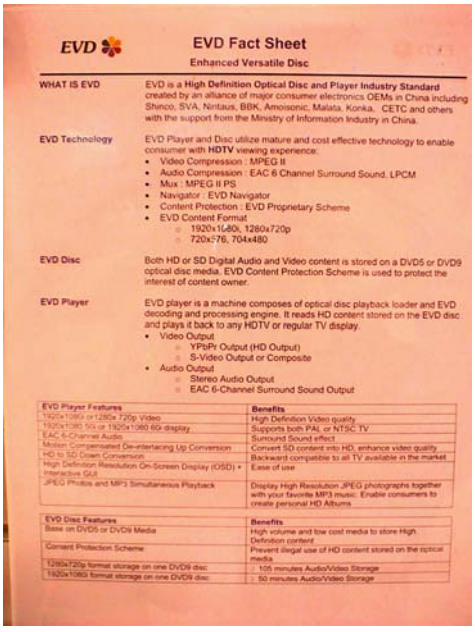
Chinese Hi Def DVD

The full coverage of this subject can be obtained from the HDTVetc magazine article I recently wrote about the subject, please consult **www.hdtvetc.com**. Last year at CES I met with a Chinese manufacturer of the EVD player, the Chinese Hi Def DVD, the company was one of the nine Chinese electronics manufacturers that made

an EVD industry alliance in 2003 to develop and promote EVD players. EVD is not alone anymore; the Chinese industry has grown to four formats now.

EVD decoder products have been manufactured by Beijing Homaa Microelectronics Technology and Beijing E-world Technology, in cooperation with United States-based LSI Logic. Below is the EVD player introduced last year, over the right, the specs for the EVD format:

EVD 500 Chinese High Def DVD Player



EVD Fact Sheet

Enhanced Versatile Disc

WHAT IS EVD

EVD is a **High Definition Optical Disc and Player Industry Standard** created by an alliance of major consumer electronics OEMs in China including Shinco, SVA, Nintaus, BBK, Amoisonic, Malata, Konka, CETC and others with the support from the Ministry of Information Industry in China.

EVD Technology

EVD Player and Disc utilize mature and cost effective technology to enable consumer with **HDTV** viewing experience:

- Video Compression : MPEG II
- Audio Compression : EAC 6 Channel Surround Sound, LPCM
- Mux : MPEG II PS
- Navigator : EVD Navigator
- Content Protection : EVD Proprietary Scheme
- EVD Content Format
  - 1920x1080i, 1280x720p
  - 720x576, 704x480

EVD Disc

Both HD or SD Digital Audio and Video content is stored on a DVD5 or DVD9 optical disc media. EVD Content Protection Scheme is used to protect the interest of content owner.

EVD Player

EVD player is a machine composes of optical disc playback loader and EVD decoding and processing engine. It reads HD content stored on the EVD disc and plays it back to any HDTV or regular TV display.

- Video Output
  - YPbPr Output (HD Output)
  - S-Video Output or Composite
- Audio Output
  - Stereo Audio Output
  - EAC 6-Channel Surround Sound Output

EVD Player Features	Benefits
1920x1080i or1280x 720p Video	High Definition Video quality
1920x1080i 50i or 1920x1080 60i display	Supports both PAL or NTSC TV
EAC 6-Channel Audio	Surround Sound effect
Motion Compensated De-interlacing Up Conversion	Convert SD content into HD, enhance video quality
HD to SD Down Conversion	Backward compatible to all TV available in the market
High Definition Resolution On-Screen Display (OSD) + Interactive GUI	Ease of use
JPEG Photos and MP3 Simultaneous Playback	Display High Resolution JPEG photographs together with your favorite MP3 music. Enable consumers to create personal HD Albums

EVD Disc Features	Benefits
Base on DVD5 or DVD9 Media	High volume and low cost media to store High Definition content
Content Protection Scheme	Prevent illegal use of HD content stored on the optical media
1280x720p format storage on one DVD9 disc	: 105 minutes Audio/Video Storage
1920x1080i format storage on one DVD9 disc	: 50 minutes Audio/Video Storage

The four formats use red laser: High-Definition Videodisc (HDV), High-Definition Versatile Disc (HVD), Enhanced Versatile Disc (EVD), and in November 2004, the Forward Versatile Disc (FVD) was introduced in Taiwan.

EVD and HVD use MPEG-2, and FVD uses WM9. Studios such Paramount, MGM, and Miramax have released some WM9 titles in Germany; Disney has released some titles in Italy. Universal has some HVD movies in China, and Sony and Miramax has some EVD in China. According to Beijing K-City, who sold 6000 HDV players to France, there were 400 HDV titles available in China.

Please review the subject with more detail and the conclusions on the mentioned HDTVetc magazine article.

HDTV Recorders and Tuneless DVRs

Although there are HD DVRs included on this section, they are tuneless. The HD DVRs with tuners are included in the HD-STB section. Please refer to both sections to have a complete picture of HD DVRs.

If you are looking for a DVR that connects to a tuner you already have (as STB or as integrated TV tuner) you will need to use IEEE1394/DTCP protected digital connections to send the signal for recording.

Some units are only compatible with certain equipment, like the Symbio DVR from Toshiba, compatible only with some newer integrated TVs from Toshiba (down below).

Elgato

On June 2004, the company announced the first HDTV recorder for Mac OS X EyeTV 500 $350, ATSC tuner, pause, RW, FF through television while watching, record HD on Mac's HDD, EPG from Titan TV, remote programming, archive onto DVD, requires Power PC® G4 500Mhz or G5 w/built-in 1394, 8GB HDD space per HDTV hour, DVD recording via Roxio's Toast 6 Titanium software, Internet connection for TitanTV EPG.

JVC

D-VHS

On July 2004, JVC announced two new digital D-VHS VCRs, the HM-DT100 (Aug 04, $1500) and the HM-DH5 (Jul 04, $800). The HM-DT100 features integrated HDTV tuner, HDMI, 4hr recording/playback on DF-480 tape, 5.1 DD, and all basic analog VCR functions. The HM-DH5 will have the same except for the HDTV tuner.

The other model (HM-HD40000U) details are in the CES 2004 report, and the earlier model 30000 in the CES 2003 report.

JVC Portable HDTV Recorder

On February 2004, JVC announced a new portable HDTV recorder, the model CU-VH1, TTM Feb 04, MSRP $2,000, uses standard miniDV and HDV format cassettes. Records and playback HD and SD miniDV video, and progressive HD, SD and DV 1280x720 JPEG still images stored on SD/MMC memory cards.

The unit is positioned as a post-production complement to the GR-HD1 and JY-HD10 HDTV camcorders; it will not record signals from DTV set-top-tuners. There are no plans for pre-recorded media.

Has a 3.5-inch LCD monitor (240k-pixel), iLink for non-linear editing/dubbing, HD component video outputs, SD card slot for capturing stills from tape and

transferring them to a PC using a USB connection. Play back signals recorded in 720p/30fps (MPEG-2), 480p/60fps (MPEG-2), and 480i/60fps (DV).

Up-down conversion so HD recordings can be viewed on regular TVs. Frame-doubles 720p/30fps HD recordings for viewing on progressive 720p/60fps monitors, or converts 480p/60fps or 720p/30fps signals to 1080i. Downconverts 480i/p 60fps to playback on progressive or NTSC monitors. 16:9 footage can be played back on 16x9 or 4:3 letterbox modes. Recording is possible as digital-to-digital with iLink/USB (PCs), or to/from analog devices.

Mitsubishi
The company D-VHS models are included in the CES 2003 Report.

Marantz
MVS8300 D-VHS model is included in the CES 2004 Report.

Sony
Nov 04

Sony of Canada announced the HVR-M10U VTR world's first professional HDV 1080i video tape recorder that contains similar capabilities as the HVR-Z1U companion professional camcorder: Multi operation for DV, DVCAM or HDV modes, support for 1080i/60/50, NTSC or PAL scan rates, down-conversion circuit for flexible HD/SD operation, AC/DC operation, 3.5" 16:9 LCD viewer, Time Code support.
TTM Jan 05, $5150, **www.hdv-info.org**.

Thomson
May 04 (company announcement of 2004/5 models)

Two new RCA Scenium HD DVRs
Interface w/new integrated TV sets via IEEE-1394 connections; recognize DTCP and Broadcast Flag

DVR2160	$550, 80 hours of SD, 18 hours of HD recording
DVR2080	$450, 40 hours of SD, 9 hours of HD recording

Toshiba
May 04 (company announcement of 2004/5 models)

Toshiba introduced an HD 160GB digital video recorder (Symbio 160HD4, $500) to connect via IEEE-1394 with their integrated sets. The programming circuitry is based in part on Gemstar's TV Guide Onscreen interactive program guide, and since is built within Toshiba's fully integrated HDTV sets it makes the Symbio compatible only with those sets.

HD Signal Processors

Algolith

Silicon Optix/Teranex is planning to make available the new Realta HQV chip as OEM to manufacturers that want to implement it on their video processing, and Algolith has already in the works a scaler/noise reduction unit that incorporates the chip, the unit is expected to come out in Jun/Jul 05, its name is “Dragon Fly”, and it will have a $3499 MSRP.

On a conversation I had with Mr. Michael Poirier, VP of Sales and Marketing of Algolith, he indicated that the specs of the “Dragon Fly” are still in development at this time, but the unit is expected to output 1080p/60 frames x second refresh rate from various input rates from 480i to 1080i, he indicated that by the time the unit is out it might happen that the 1080p output could be offered at other refresh rates such as 24fps or 30fps if the particular application benefits from those rates.

Center Stage

Apr 04
Scaler CS-2 $2,500, TTM now, DVI/HDCP input signals decrypted and processed to DVI/HDCP output, no analog output (applicable to protected DVDs). DVI input signals without HDCP are processed over DVI and analog outputs. DVI input is not 1080i compatible, and it wont pass-thru 1080i either, which means it is needed a separate switcher.

Cinemateq

Sep 04
Picture Optimizer $1075, seven resolutions scaler, RGBHV, RGBS, RGsB and YUV, 3 video inputs, five AR conversions

Picture Optimizer Plus SDI $1850 (without SDI option), integrates 22 possible resolutions up to 1080p, distributes doubling at 120 Hz NTSC, or tripling at 90Hz NTSC, quadrupling at 72 Hz NTSC, or wide XGA 90Hz with NTSC. 8 inputs that can be configured individually.

Faroudja

Video Processors
DVP-1000 $7000, selectable output scan-rates
DVP-1500 $10000, w/DVD drive
DVP-1010 $4000, updated from the DVP-1000, variable resolution, input/output DVI/HDCP compliance, TTM now, from 800x600 to 1920x1080 selectable resolutions, YPbPr input/output, RGB in, RGBHV out, DCDi, DVI transcoding from analog component
DVP-1080 $6500, TTM mid Feb 05, similar specs as 1010

DVP4000 $15000, TTM now, included in the CES 2004 report.

Native Rate fixed-resolution units discontinued

Key Digital
Sep 04
HD Hanna $2500, TTM Sep 04, Video processor/digital STB/video switcher, 1394/DTCP, DVI-D, ATSC/NTSC tuners, nine output resolutions, 1394/DTCP, RGBHV D-sub, DVI-D, Toslink audio output, scales up YPbPr component signals with optional expansion card, simultaneous SD and HD signal output,

Digital Blaster $2500, TTM Sep04, ATSC STB, converts SDI (480i and 1080i signals) to DVI-D output, output formats 720x480p at 60Hz, 1280x720p at 60Hz, 1280x768p at 60 Hz, 1280x1024p at 60 Hz, 1920x1080i at 60 Hz, 1920x1080p at 60 Hz, 1920x1080p at 24 Hz, and pass-through. Signal processing is fully in the digital domain without converting it to analog. Accepts Serial-Digital Interface (SDI) signals at the 270 Mb/s (SD) or 1.485 Gbps (HD) bit rates. RGBHV output over D-sub.

Lumagen
VISION DVI $1000, eight inputs (includes 2 SD/HD component and 2 DVI/HDCP), DVI output, DVI input accepts 480i, 1080i, 480p and 768p, Multipoint gray scale calibration, individual memories, transcodes component video and RGB analog to DVI-D.

VISION HDP $1500, eight inputs (includes 2 SD/HD component and 2 DVI/HDCP), DVI-I output, optional BNC output, adds 1080p output resolution, 1080i deinterlacing to 1080p, transcodes component video and RGB analog to DVI-I (digital and analog).

VISION Pro HDP $2300, ten inputs (includes 2 SD/HD component and 2 DVI/HDCP, component cables, front LCD display & controls, BNC connections for analog inputs/output.

Silicon Optix
Image AnyPlace Video Scaler $2500, professional quality HD deinterlacing, and eWarp Engine $1500 for projector placement angles +-40 degrees horizontal, and +-30 degrees vertical, DVI and VGA connectivity, TTM current. This processor does not have the HQV chip from Teranex.

HDTV Video Cameras

HDV Format

HDV was announced in the summer of 2003 and was established as an official format in the fall of 2003. Canon, JVC, Sharp, and Sony are the primary manufacturers supporting this HD format that uses mini-DV videotape, MPEG-2 and at resolutions of 1080i and 720p. The companies indicated that camcorders could be made that can record on the same mini-DV both regular and HD formats.

Ikegami

Sep 04

HDK-75EX digital HDTV camera system, 12-bit A/D conversion digitizing video signals, 39-bit internal digital processing circuit, performs digitally non-linear processing (such as gamma correction), 4.5 Kg with fiber adaptor excluding lens, only 28w of power consumption, 1000 TV lines of horizontal resolution, next generation 0.18 micro m ASICs in the new CCU-790A Camera Control Unit, frame multi-format conversion for 24p, 30p, 50p, 720p, 1080i, 480i, etc. **http://www.ikegami.com/br/products/hdtv/hdk75ex.html**

JVC

The current model for 720p (on the right) was included in the CES 2003 Report GR-HD 1, TTM March 2003, MSRP estimated at around $3,000, records in Mini DV tape at native 720/30p, 480/60p, and 480i, plays back 1080i, 720p, 480p, and 480i.

On April 2004, the company announced a prototype of a H/DTV video professional-grade camcorder using three 2/3-inch CMOS imager chips of 1920x1080 each adaptable to 720p and 1080i, and with an MPEG-2 encoder, capable of progressive 24fps HD, and utilizing the new HDV recording format for 276 minutes on full size DV media, and up to 60 minutes on mini-DV media.

Sony

On April 2004, Sony announced that it would introduce at NAB 2004 a HDV based camera for US consumers that was demo at the CeBIT 2004 IT and telecommunications show in Hanover, Germany. Later in September the camera was released as the HDR-FX1, a 3 1/3-inch 16:9 1.12 Megapixel gross CCDs, HDV Camcorder, each CCD of 960x1080 oblong pixels for 16x9, 1080i, MPEG-2, uses standard MiniDV tapes, Carl-Zeiss lens, zoom ring, focus ring, iris /aperture ring, manual controls, $3700 MSRP expected to sell at around $3400, upgrade options from hi-end Sony cameras are offered.

On November 2004, Sony 's Business Solutions & Systems Group introduced the HVR-Z1 HDV Camcorder, $4900, TTM Feb 05, similar CCD optical-block as the HDR-FX1 above, with three 1/3-inch Super HAD 16:9 CCDs, each CCD has 1.2 megapixels in a 960x1080 matrix, and due to offsetting the green CCD one-half element spacing from the red and blue CCDs, attain additional luminance which increases the horizontal resolution 150%, obtaining a resolution of 1440x1080 encoded as MLMP-14 MPEG-2. A version of the camera would be for Region 60 (1080i/60 and 4:3, 16:9 NTSC PAL DV), and another for Region 50 for 1080i/50 and 4:3, 16:9 PAL DV. 3.5-inch LCD viewfinder with 250,800 pixels.
http://news.sel.sony.com/pressrelease/5331

Also, Sony Media Software announced Cineform's Connect HD application software for Vegas 5 editing software users at a promotional price of $150, which improves the HDV editing capabilities within Vegas by capturing and export HDV images between the HVR-Z1U and other HDV cameras.

Back in September 2004, Ulead Systems announced their plans to support the Sony HDR-FX1 with cost-effective HD video editing within MediaStudio Pro, their professional software suite.

HDTV IC Chips

Aurora

The company announced a new 1080p HD LCoS panel in October 2004, the ASI6000, a 0.7-inch diagonal 1920x1080 microdisplay panel, and its ASI6100 companion driver for RPTVs. The panel is an upgrade path to existing ASI5000/5100 panel implementations, minimizing the optical system changes.

Broadcom Corporation

On April 22, 2004, Broadcom Corporation announced the BMC3520 chip; an advanced single-chip DTV receiver for cable and digital broadcast integrated with an NTSC analog tuner, with plug-and-play features. One main characteristic is its ability to acquire, track and demodulate signals in an environment of interference and multi-path noisy conditions, exceeding VSB performance. The BMC3520 is priced at $20 each in 10,000 units, and is packaged as 144-pin PQFP with stereo audio.

ELCOS

The company was expected to show at CES their implementation of their chip on an LCoS RPTV of 60 inches (eHD70), 4000:1 CR, 1920x1080 eHD70, 90000 hours lifetime; the chip could be applied to FPTV and RPTV. They also have the eWX70 with 1280x768, 1000:1 CR

Intel

On Aug 2004, Intel announced a delay on their plans to release their first LCoS chip for projection sets. Their competitor, Advanced Micro Devices Inc., is continuing as planned. Intel anticipated that the chip would not be ready by the end of 2004, as announced at CES 2004 in January. There were no technical problems reported as the reason of the decision.

Later in October 2004, Intel announced that was canceling the plans to produce LCoS chips.

Philips

On Oct 04, Philips announced that it has decided to discontinue their LCoS business with engines and RPTV, the company indicated that it had invested approximately $200 million in LCoS, the RPTV market was too small, and is not willing to increase the investment for the company to compete with these products. Operations were planned to stop on November 19, 2004. Philips also announced that it has cut $500 out of the MSRP of the remaining models, and will continue CRT RPTV production.

Samsung

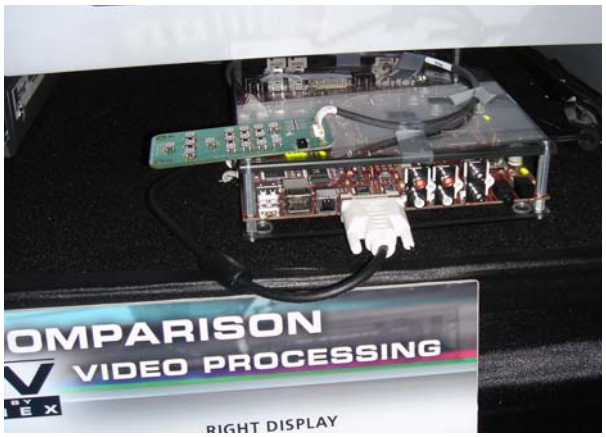
On January 2005, the company announced their development of a new DTV receiver chip (S5H1406) designed to perform well in harsh conditions of multi-path and weak signal conditions. The chip will be made available by 1Q05 in the Asia region.

Silicon Image

The company introduced in January 5, 2005 the SiI 8100 IC video-processing chip with HDMI connectivity capabilities. In addition, Silicon Image has introduced a number of chips for HDMI connectivity for the manufacturing of H/DTV equipment. Please consult the full detail on the HDMI Connectivity Chips section.

Silicon Optix

Silicon Optix joined (and later bought) Teranex to implement a video processor in a single chip called Realta HQV (Hollywood Quality Video). The chip is a programmable DSP that can perform one trillion operations per second and is able to upconvert 1080i to 1080p at up to 120 fps. The company showed the product at CES 2005 in an interesting comparison setup. The first consumer product to implement the Realta HQV chip is the Denon-5910 DVD player, $3500 TTM 1Q05 (see later on the report).



The technology HQV was developed by Teranex and previously used in professional products costing $60000 and up. It employs pixel-by-pixel processing, scaling, detail enhancement, etc and is fully programmable for receiving future firmware upgrades. The quality is so good that it has won fourth awards since its introduction in the 4Q04, and the Best of Innovations CES 2005 award.

I witnessed a demo offered by Ray Lego, Product Manager of Teranex Business Unit at Silicon Optix Inc, and by Menno Stoffels, Director of Systems Engineering of Silicon Optics Canada Inc. We went thru a side-by-side comparison of the effect of the product in direct-view TVs, RPTVs and FPTVs, with varied material that showed the improvements in typical test content like the flag, building bricks, noise in building windows, etc.

It will be a big step forward for the H/DTV industry if manufacturers start considering the inclusion of this chip into their products as an option to whatever they are using now, especially considering that 1080p displays are here and now.

Silicon Optix/Teranex is planning to make available the new Realta HQV chip as OEM to manufacturers that want to implement it on their video processing, and Algolith has already in the works a scaler/noise reduction unit that incorporates the

chip, the unit is expected to come out in Jun/Jul 05, its name is “Dragon Fly” and it will have a $3499 MSRP.

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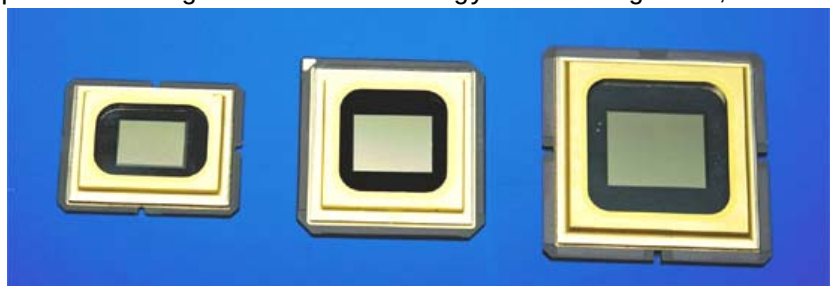
STMicroelectronics

On Sep 04 the company announced the Sti7710 integrated chip for HD-STBs, which combines the functions of the Sti7020 HD decoder IC and the Sti5517 Omega decoder, adding Hi-speed USB (480-Mbps, 40 times faster than USB 1.1) which would permit external expansions of additional DVRs, and HDCP processing features to its DVI and HDMI connections. The company is the world’s larger supplier of MPEG-2 decoder silicon chips for STBs (77% of the market). Production is planned for 1Q05 at a volume price of $18.

Texas Instruments

On December 2004, TI announced that they have already reached their 5 million mark of sold products using their DLP technology. According to TI, in perspective, it took 5 years to reach the first million (until December 2001), two additional years to reach the two million mark (until August 2003), by March 2004 the three million (six months later), and 4 months later the fourth million mark.



Non-display Equipment with HDMI/DVI/IEEE1394 Capabilities

This year a larger number of units implementing DVI and HDMI were released, in addition to the monitors and integrated TVs mentioned on the previous sections.

Although the implementation of HDMI inputs/outputs was also seen in more receivers, it is still mainly reserved for top-of-the–line receivers, which usually are on the $4000-$6000 range.

The data included below is an example of some of the new units, not a complete list.

HDMI/DVI Receivers/Switching

Denon
AVP-1x Studio Reference Video Preamp, DVI/HDCP, HDMI switching, video upconversion

<u>New Denon receiver with multiple HDMI</u>

In addition to the current AVR-5805 $6000 receiver with 3 HDMI/ 1 DVI inputs and one HDMI output (introduced in Sep 04), Denon announced at CES 2005 a new receiver AVR-4806 for $3000 due in March 2005 with 3 HDMI 1.1 (2.0) inputs (that can be used for DVD-Audio signals), one DVI input, a DVI-converting HDMI output, a IEEE1394 input for DVD-Audio/SACD, and a proprietary Denon Link DVD-Audio input. Three video zones, component video upconversion, S-video up-down conversion, Audyssey Lab's MultEQ for correction of room acoustics with multiple listeners, Dolby Headphone, Dolby Virtual Speaker.

Halcro
<u>Surround processors</u>
With HDMI outputs, deinterlacing upscaling to 1080p on HDMI, A/D conversion
SSP100 $10000
SSP80 $8000

Integra Research
Sep 04
RDC-7.1 preamp/processor, TTM Nov 04, $4000, HD radio and XM upgrade cards available after introduction.

JVC
RXD701/702B A/V top end receiver with 7x150 watt channels, HDMI input w/upscaling HDMI output, Dolby Prologic IIx, USB input for PC connection, built-in 802.11 2.4 GHz receiver for streaming audio, wireless transmitter that plugs into a PC's USB input

Marantz
CES 2005
SR9600 140x7 watts A/V receiver, 2 HDMI in/ 1out, IEEE1394 connection, $3500, TTM Apr 05, video upconversion to component analog from 480i S-video/composite w/TBC

SR8500 125x7 watts A/V receiver, 2 DVI in/ 1 out, $1600, TTM current

Onkyo
TX-NR1000 $4000, 7.1 channels x150 watts, HDMI, IEEE1394

Samsung
Oct 04

Samsung announced for March 2005 the introduction of its first A/V receiver for a price ranging the $4000-$5000 mark. The receiver will have 7x250 watt amps, 3 two-channel audio zones with its internal digital amplifier, RS-232, DC triggers, IEEE1394 input for DVD-Audio and SACD, two HDMI inputs and one output, two DVI inputs and one output, automatic room equalization, video up-conversion over HDMI or DVI, up-scaling of DVD to HD, FM tuner.

CES 2005
The receiver announced above was demo at CES with a model # AV-R3000, for $5000, TTM Jun/Jul 05, 4 HDMI inputs/one HDMI output, 2 DVI inputs/ 1 DVI output, 250x7 watt channels, video upscaling, component 480i upscaled to 1080i of not-protected content

Sony
CES 2005
ES Series A/V Receiver
STR-DA7100ES $2000, 170 Watts x 7, 7.1 channel A/V receiver, HDMI switching, 720p/1080i upconversion, 32-bit S-Master Pro Digital Amplifier, iLink IEEE1394 for audio, independent 5.2 channels and 2 channel surround, second zone video/audio, third zone audio only.

HDMI/DVI DVD players

Denon

New Denon DVD player DVD-5910 for $3500 with 1394 output for DVD-Audio/SACD, and HDMI output for DVD-Audio, the first DVD player to use Teranex de-interlacer chip Realta HQV, simultaneous SD and HD outputs.

Integra
Sep 04

Five-disc universal DVD player with HDMI; single DVD-Audio/video players are discontinued.

Integra Research
Sep 04
Universal RDV-1.1 $4000, TTM Oct 04, HDMI/HDCP input/switcher to connect other HDMI components thru the DVD player.

Marantz
Sep 04
DV9500 first universal DVD player to incorporate HDMI with upconversion, TTM Oct 04, $2100, DVD-Audio, and SACD with full bass management, Dolby Headphone

Theta
Compli universal DVD player, $5900, DVI card for 480p, component

Yamaha
DVD-S2500 first universal player with HDMI/HDCP upconverts to 720p/1080i, $700, TTM Jan 05

Digital Connectivity

DVI

The DVI (Digital Visual Interface) 1.0 specification was introduced in April 1999 by the Digital Display Working Group integrated by Silicon Image, Intel, Compaq, Fujitsu, Hewlett-Packard, IBM and NEC for the purpose of creating an digital connection interface between a PC and a display device. It is a connection with enough bandwidth for uncompressed HD signals.

The 1.0 DVI specification is a point-to-point solution that supports video content but not audio. DVI uses the Transition-Minimized Differential Signaling (TMDS) protocol developed by Silicon Image. PanelLink is the Silicon Image's proprietary implementation of TMDS.

The HDCP (High-bandwidth Digital Content Protection) 1.0 specification was developed by Intel with contributions from Silicon Image in February 2000 to protect DVI outputs from being copied by providing a secure link between a video source and a display device.

HDCP offers authentication, encryption, and renewability. The Motion Picture Association of America (MPAA) endorsed HDCP as the standard for the secure transmission of HD signals over DVI.

Most new DTV monitors and integrated displays have incorporated DVI or HDMI inputs, although on their first generation some panels were not HDCP compliant, now there is a large volume of H/DTV equipment that is. However, some displays were reported to have interoperability problems regarding DVI/HDCP or HDMI/HDCP.

The DVI standard is able to handle single or dual link connections. A single-link connection supports up to UXGA resolution of 1600 x 1200 at 60 Hz. Dual-link connections provide bandwidth for resolutions beyond QXGA (2048 x 1536).

According to DVI specs a single link has 165 MHz/pixels capacity for 3 channels, Red, Green and Blue, each channel could support up to 1.65 Gbps speed rate, or a total of 4.95 Gbps for the 3 channels (165 MHz x 30 bits x sec). Dual-link connections double that capacity to 330 MHz, with a speed-rate capacity up to 9.9 Gbps.

The 1080i HD format has 1125 total lines of 2200 pixels x frame (active image 1080x1920), requiring 74.25 MHz/pixels (1125 x 2200 x 30fps). Each pixel contains data for RGB and is implemented by DVI with 30 bits (8 per each color plus another 6 for encoding). An HD 74.25 MHz/pixel signal would require 2.2 Gbps speed rate.

A link of 3 channels supporting 165 MHz is sufficient for the 74.25 MHz HD 1080i signal without requiring the use of the second link, and will also be sufficient to transport a 1080p/60 frames x second signal at 148.5 MHz without requiring the second link.

If the signal to be transmitted would be higher than the single link capacity of 165 MHz, it would require the use of a dual DVI link connection, each link will carry half of the signal; the second link cannot be used with just what is exceeding 165 MHz of the first link. For example, a 200 MHz signal would be carried with both links operating at 100 MHz each.

HDMI uses the same 165MHz capacity per link; dual-link uses the B connector with the second link pins.

DVI identifies and auto-configures the connected device. If source equipment is connected with DVI single link to a display configured as dual link DVI, the image will experience a lower resolution. Some first generation single link DVI cables use dual link connectors. DVI standard cables have typically a five-meter distance limitation, although with better quality wiring, such as fiber-optic, higher distances are possible.

There are three types of DVI connectors:

DVI-I (integrated), carries a single or dual-link digital signal, with an additional analog signal for legacy devices. The 29-pin DVI connector uses 24 pins for the digital data stream (12 for each link) and 5 pins (1 plus -shaped blade and 4 pins) to carry analog audio/video and ground.

DVI-I

DVI-D (digital) carries digital-only video data to a display. It is designed for 12 or 24 pin connections, and single/dual link operation (notice the lack of 4 pins, 2 above/2 below the flat blade).

DVI-D

DVI-A (analog) is available for legacy analog applications to carry analog signals to a CRT monitor or an analog HDTV (claims to be better than VGA). The three rows of eight pins have three pins missing in the first row, five missing in the second row and four missing in the third row, and that the "flat blade" contact seen to the left has two contacts above and below it. There is no single or dual link in analog cables.

DVI-A

Regarding connecting plugs to receptacles:

A DVI-D plug can be connected to either DVI-D or DVI-I receptacles,
A DVI-A plug can be connected to either DVI-I/A or VGA (w/adapter) receptacles,

A DVI-A receptacle would accept DVI-I but not DVI-D.
A DVI-I plug can be connected to either DVI-I or DVI-A receptacles (the 'A' ignores 'I's digital pins)

IEEE1394

IEEE1394 is a digital interface conceived by Apple Computer in 1986, and it was called "Fire Wire" for its fast speed of operation. In 1995, the Institute of Electrical and Electronic Engineers (IEEE) adopted the serial bus as its standard 1394. Sony trademarked their name iLink for their implementation of the 1394 bus as a 4-pin connector.

In March 2000, an updated specification was approved, the 1394a. The "a" standard supports speeds of 100Mbps, 200Mbps, and 400Mbps over a distance of 4.5 meters, and up to 63 peer-to-peer nodes/devices.

In 2001, the IEEE 1394 "b" standard emerged as a network technology (rather than as serial bus); it is capable of moving data streams at faster speeds over longer distances than the original.

The "b" standard specifications were intended to support up to 3,200 Mbps depending on the cable material, and permit the use of cabling materials not supported by the "a" standard. It supports speeds up to 100Mbps over 100 meters of Category 5 wiring, 400 Mbps over 100 meters of plastic optical fiber, and up to 3,200 Mbps (or 3.2 Gbps) over 100 meters of glass optical fiber.

The "b" standard is compatible with the "a" standard; if an "a" device were plugged into a "b" component, the bus would deliver a maximum speed limited by the "a" standard (400Mbps). Each "b" device can be set up to 100 meters apart from the next in sequence, allowing the total network to be quite significant in cable length.

The licensing fee for the use of the patented technology is $ 0.25 per system; chipsets are less than $5 each in volume.

It supports hot swapping and plug-and-play, so a consumer's 1394 bus can recognize automatically a 1394 device when it is connected/disconnected, and reconfigure itself.

The connection is now being used by a growing number of DTV equipment manufacturers for the transmission of compressed HD signals, such as D-VHS recording and networking DTV equipment.

There are three types of cables used for 1394. The 6-conductor type has two separately shielded twisted pairs for data and two power wires in an overall shielded cable with 6-pin connectors on either side. The 4-wire cable uses two separately shielded data cables without power wires in an overall shielded cable with 4-pin connectors on either end. The third type of cable uses either type of actual cable, with a 6-pin connector on one side, and a 4-pin connector on the other side of the cable.

The 4-pin connector is more common on digital video camcorders and other small external devices because of it's small size, while the 6-pin connector is more common on PC's, external hard drives due to it's durability and support for external power for 1394 peripherals.

6-pin female connector on left.
4-pin female connector on the right

The 6-pin male connector

4-pin male connector

HD signals are broadcast in compressed MPEG-2 format at approximately 19 Mbps. D-VHS VCRs are able record compressed HD signals and require a 1394 connection to receive the digital data stream. HDTV monitors require a MPEG-2 decoder to decompress the signal for display, as oppose to DVI that is uncompressed.

DTCP (Digital Transmission Content Protection) has been created for the purpose of copy protection over the 1394 connection. DTCP is also known as 5c for the five companies that participated on the standard (Sony, Toshiba, Intel, Hitachi, and Matsushita).

During the last two to three years, there have been many discussions (and hype) about using these types of digital connections (DVI and 1394) for DTV equipment, rather than only the analog connections (component YPbPr, RGB, RGBHV, etc), for protecting HD digital content.

Since 2003, most manufacturers released a large variety of products adopting these two connections to enable their equipment for digital connectivity, IEEE1394 for compressed HD video from integrated TVs with tuners, cable and OTA HD-STBs mainly for recording purposes, and DVI for uncompressed HD video for the viewing of protected content (using HDCP).

HDMI is quickly replacing DVI and is being implemented already on many products, and is becoming the de-facto standard for transporting uncompressed signals over a cable.

HDMI

On December 9, 2002, the seven founders of HDMI (High-Definition Multimedia Interface) announced the 1.0 specification of this connectivity standard, the enhanced, more robust form of DVI. The seven founders are Hitachi, Matsushita, Philips, Silicon Image, Sony, Thomson, and Toshiba.

The standard supports HD uncompressed video, 8-channel digital audio (reportedly up to 192 KHz), and some control signals on a single cable (15 mm, 19 pin), while using less than half the available bandwidth.

HDMI has the same video capacity as DVI, or up to five Gbps of bandwidth, double what a HD signal would require, and is backward compatible with DVI by using an adapter.

Not included in the standard but used with DVI and HDMI is the HDCP (High-bandwidth Digital Content Protection) protocol. HDCP is licensed by Intel, designed to protect HDMI and DVI signals from piracy, and used for authentication between A/V products.

In 2003, a license fee of five cents was applied to each product (four cents for HDMI, 1 cent for HDCP), that manufacturers had to pay to the HDMI founders and Intel.

HDMI Multi-channel Audio

In recent articles, there were claims that HDMI was not implemented by some manufacturers as a full multi-channel connection. The confusion comes from the fact that the majority of first-generation HDMI devices were TVs with only two-channel stereo, which have no use for the full multi-channel signal. However, most other equipment, from DVD players to A/V receivers, switchers, etc, is capable to receive, process, mix, or send the full multi-channel audio content across HDMI.

According to Silicon Image, there is a two-way communication between the source device and the receiving device by which the receiving device tells the source about its multi-channel capabilities. The source device can then send a matching signal, such as two-channel stereo to a TV, or 5.1 DD channel to an A/V receiver. In other words, the source device adapts to the receiving device when sending the signal.

In the case of an A/V receiver receiving the signal from a 5.1 DD DVD player, both ends of the connection recognize the need to maintain the 5.1, but the receiver might redirect the signal to a TV that needs only L/R channels, for which the output of the receiver adapts on only that output jack by down-mixing the DD stream.

HDMI chips introduced on the first generation batch distributed to manufacturers did not have the capability of 1080p; second and third-generation chips (mentioned in the next section) have such capability now. Some 1080p TV sets might not accept a 1080p input for reasons of their internal design but also for the use of the first batch of chips.

HDMI Connectivity Chips

Silicon Image:

A year ago, at CES 2004 the company announced the introduction of three PanelLink HDMI Cinema ICs for more features, lower cost per port, DVD-Audio support, higher video resolutions, more sampling frequencies, more HDMI ports, etc:

SiI 9030 transmitter, targeted at the DVD-Audio players/recorders and receivers, supports D-Audio at 32-192kHz frequencies, backward compatible with SiI 9190 1st generation transmitter, 25-112 MHz video bandwidth, compliant w/CEA-

861B and HDCP1.1, will support digital audio through S/PDIF digital audio interface, will support Plasma/LCD w/1024 lines (WSXGA)

SiI 9021 receiver, dual HDMI inputs, designed for DTVs, backward compatible with first-generation SiI 9993 receiver chip, compatible with CEA-861B and HDCP 1.1, 25-112 MHz video support for Plasma/LCD w/1024 lines (WSXGA)

SiI 9031 receiver, targeted at Home-theater receivers, DVD-Audio support, sample frequencies of 32-192kHz, dual HDMI inputs, backward compatible w/SiI 9993 first-generation receiver, HDMI 1.0 compatible, CEA-861B and HDCP 1.1 compatible, 32-112 MHz video bandwidth for support of Plasma/LCD (WSXGA) 1024 lines of resolution, support of compressed digital audio through S/PDIF interface.

CES 2005

On January 5, 2005, Silicon Image announced a couple of new products, both supporting 1080p:

SiI 8100: The first integrated video processor with HDMI/HDCP, HD RGB/YPbPr component video, and SD inputs, targeted to low-cost LCD and CRT TVs. The processor performs video scaling, state-of-the-art 3D motion-adaptive video deinterlacing, programmable hue, saturation, brightness and contrast adjustments, 50 Hz to 60Hz video rate conversion, PIP and picture overlay, and is suited with an 8-bit on-screen display capability for graphics, menus, and EPGs.

The SiI 8100 is packaged as a 256-pin LQFP and comes with a complete set of hardware and software development tools for manufacturer implementation. TTM 3Q05 (sampling May 05), $13.95 in 10K quantities,

SiI 9011: HDMI/HDCP low cost third generation PanelLink Cinema Receiver, HDCP repeater, backward compatible with prior-generation SiI 9021, 9031, 9993 HDMI receivers, supports DVD-Audio and 7.1 audio at 96 kHz, and stereo at 192 kHz, interfaces with 12, 24 and 48-bit modes, available in 128-pin LQFP and 144-pin TQFP. LG and a number of other manufacturers are incorporating the IC in their new line of plasma and LCD models. TTM current, $6.95 in 10K quantities (128-pin version).

To provide consumers with a simple means of identifying HDTVs and other consumer electronics devices capable of receiving and playing the most valuable digital content, Silicon Image operates the PanelLink Cinema (PLC) Partners Program. The PLC Partners logo assures consumers that HDMI systems bearing this logo have been tested for HDCP functionality and content-readiness, meaning they are interoperable and ready to receive and play premium digital content. Sony, Mitsubishi, Samsung, Hitachi, LG, Sanyo and others have joined the program, which also has broad industry support from content providers The Walt Disney Co., Fox, Universal and Warner Bros. The first PLC-compliant TV, a 50" plasma from LG, was shown at CES.

Other Digital Connectivity - Update

On May 2004, the 1394 Trade Association announced their plans to enhance the FireWire standard by making it wireless and adding the 1394c standard to permit 1394 and Ethernet to share a CAT-5 cable network, and is expected to automatically sense either at the wall-jack, although the first version night require a manual switch.

There is also in development an enhancement to use coaxial cable and CAT-6 for 1394b signals, and an extension of the current 50-meter limitation over plastic optical fiber at 250Mbps. Regarding wireless IEEE1394, the association approved PAL (Protocol Adaptation Layer) to allow 1394 signals to be transported over wireless IEEE 802.15.3 or over ultrawideband (UWB) 802.15.3a faster pipe.

The 15.3 standard is a 2.4 GHz dual-use standard judged as more efficient and reliable than Wi-Fi for SD and HD home distribution. 15.3 has a data rate of 55Mbps at 50 meters, and 22Mbps at 100 meters, and meet the IEEE requirement of minimum 110 Mbps at 10 meters and 200 Mbps at four meters.

On December 2004, the company Pulse~LINK introduced a new Gigabit chipset for Ultra Wide Band (UWB) wireless communication for HD signals, as an alternative to DVI, HDMI and 1394b wired solutions. The product will become available in February 2005, and has been tested to handle 667Mb/s of capacity after error correction, but has been announced that within the next 60 days it would be able to exceed 1Gb/s data rate.

On January 2005, Audio Authority announced their Cat 5 HDTV signal distribution amplifiers, model 9860 series. The 9861 ($194) Cat 5 Driver for HDTV 1080i/720p up to 1000 feet; the 9868 Adapter ($178) and 9869 Distribution Amplifier ($297) convert signals back to the original video/audio formats, the 9869 has 4 HD outputs, the 9868 has one. The system uses cable length compensation circuitry for long cable runs. The 9860 has a 9-channel wide architecture for simultaneous distribution of digital audio, analog stereo audio, composite video, and HD component video.

At CES, a new wireless network protocol (UWB) co-developed by Focus Enhancements was demo with an impressive data rate of up to 880Mbps at 3 meters, 110Mbps at 30 meters (which has sufficient capacity for up to four HD HDTV stream of 20Mbps each). UWB is 10 times the 802.11b 11Mbps common WiFi (that usually provide actual rates of half of that speed).

Content Protection

Broadcast Flag

Below is a brief summary of the Broadcast Flag. The text was extracted from an article I wrote for the HDTVetc magazine issue #6, which covers the subject of H/DTV content protection in general:

"In November 2003, to limit the indiscriminate redistribution of digital broadcast content, the FCC approved the 'Broadcast Flag' anti-piracy order. A digital code embedded into a digital broadcasting stream would signal DTV reception equipment to activate the redistribution limit. The mandate will take effect in July 1, 2005.

This regulation excludes digital devices not built with internal digital tuners, such as existing digital VCRs, DVD players, personal computers, etc. According to the FCC ruling, all existing equipment incapable of reading the broadcast flag, such as televisions, VCRs, DVD players, will remain fully functional.

The new rules still allow consumers to make digital copies of broadcast HD content; they are intended to prevent only the mass distribution over the Internet, and to encourage availability of 'high value content' on broadcast television by discouraging its migration to more secure platforms such as cable and satellite TV service, according to the FCC.

In the words of the FCC ruling documents, "The broadcast flag protects consumers use and enjoyment of broadcast video programming. The flag does not restrict copying in any way".

A demodulator (within equipment capable of tuning DTV) that complies with the flag mandate could still send the tuned signal to the analog component outputs of the device, but only to those digital outputs that meet with a copy-protection technology approved by the FCC (possibly 5c).

The FCC still needs to go thru the process of approving those future copy-protection broadcast-flag technologies; several are already pre-approved, including 5c. Companies that are part of the Broadcast Protection Discussion Group developed those technologies. Vendors of a particular content protection or recording technology need to be certified by the FCC in that such technology is an appropriate tool to give effect to the broadcast flag."

Additional background about the Broadcast Flag is on the CES 2004 report.

Broadcast Flag Implementation Update

The following is an update of how the above is been implemented.

The FCC announced on August 2004 their approval of 13 digital content protection technologies applicable in a transport-to transport and media-to-media basis, and intended to comply with the deadline of July 1, 2005 in order to implement the Broadcast Flag mandate.

Some of the technologies for the recording methods are VCPS (Vidi, developed by Philips and HP for recording DTV broadcast into DVD+R/RW discs), CPRM (4C for SD sources), D-VHS (JVC), and four versions of Magic Gate Type R developed by Sony for recording protection on Memory Stick Pro and Hi-MD.

The systems for output protection are DTCP (5C), HDCP and TivoGuard (for limited relaying among Tivo DVRs); and for Digital Rights Management (DRM) are Microsoft's Windows Media WMDRM, Helix (developed by RealNetworks), and SmartRight, developed by the SmartRight Association (of which Thomson is a member), the system establishes a personal private home network with smart-cards to deter piracy.

Under the protection conditions, content that is flagged may be subject to copy restriction and output-down-resolution when DTCP copy protection is applied over IEEE1394 (Firewire), and HDCP copy protection is applied over DVI/HDMI connections.

The Vidi recordable-DVD-system from Philips and HP will allow copies on compliant drives, not a copy of that copy.

JVC's D-VHS flagged content is copy protected, a loophole converts that flag to "copy one generation", allowing to connect to another D-VHS unit and make copies one at the time.

TivoGuard restricts by securing the registered DVR in a secured viewing group, the setup is done via a Web interface, which is password protected.

Thomson SmartRight home networking has an encoded flag making the content a private copy, that allows for up to 10 video displays and unlimited number of reception or secured storage devices in a network that can span to other physical properties of the same network owner, such as a second home, office, boat, etc.

The MS Windows Media Digital Rights Management technology works by setting a limit on the streaming and storage devices by establishing a cap on the permitted number of milliseconds of the traveling signal to keep it inside the home.

Glossary of Terms

The following are some descriptions for terms of video and audio concepts as they relate to DTV.

480i: SDTV format of 480 interlaced visible lines of 704 total pixels each (in 16:9 or 4:3 aspect ratio), or of 640 total pixels each (in 4:3 aspect ratio). 480i is per frame (240 lines x two fields) at 30 fps (frames per second). 480i/30fps is similar to interlaced DVD quality. Comparatively, NTSC color television is also 480i visible lines but is analog in a 4:3 aspect ratio with 450 pixels edge to edge (also measured as 340 TVL lines of horizontal resolution per picture height).

480p: EDTV format of 480 progressive visible lines of 704 total pixels each (in 16:9 or 4:3 aspect ratio), or of 640 total pixels each (in 4:3 aspect ratio). 480p is per frame at 24, 30, or 60fps. The 480p/60fps format is similar but in theory it should be better than progressive DVD quality, because the DVD progressive is the result of re-interleaving/line-doubling 480i/30fps stored DVD images, not 480p/60fps as EDTV, which should have better temporal resolution suitable for fast action content (like 720p is). This format was originally a SD format, in late 2000, the CEA promoted it to an EDTV level created for 480p.

5c: Copy-protection protocol used by the IEEE1394 digital connection. Also known as DTCP. The name originates from the group of five companies that developed the standard.

720P: HDTV format of 720 progressive visible lines of 1280 total pixels each in 16:9 aspect ratio. 720p is per frame at 24, 30, or 60 fps. ABC and ESPN are broadcasting in 720p/60fps. 720p is considered a better format for fast action images like sports due to higher temporal resolution than the other commonly used HDTV format (interlaced 1080i).

The higher temporal resolution of 720p allows the format to complete an image frame in 1/60 of a second while 1080i is only drawing 540 lines with half of the information of the frame of the format. On the next 1/60 of a second the 720p could record complete detail of a different fast moving image, while the 1080i would be registering picture information of only the second set of 540 lines containing only half of an image that could also have moved fast enough to produce interlace artifacts when putting the two fields together.

810i: In late 2000, when the CEA created the additional EDTV level with the DTV formats, there were a number of 4:3 TV sets that manufacturers labeled HDTVs but only showed 810i lines of a 16:9 1080i image (25% less in the vertical resolution), using a letterbox approach to convey the rectangular widescreen geometry of the HD image within the 4:3 frame of the TV.

The remaining 270i lines (1080i minus 810i) of the TV set were wasted on scanning black information for the top/bottom bars, instead of using the lines for the benefit of the image. The concept is similar to what a DVD player does when a regular 4:3 TV displays a 16:9 image as letterbox (throwing away 1 line for every 4 to maintain geometry).

The new EDTV category was placed by the CEA between the original SDTV and HDTV standards, but instead of putting those 4:3 810i sets on that EDTV category the CEA did the following:
a) The 480p sets were promoted from SDTV to the EDTV level, and

b) The 810i (non-HDTV) 4:3 DTV sets were promoted to the group of fully capable HDTV sets (720p or 1080i). With time, manufacturers of 4:3 DTV sets gradually designed those to adjust their scanning raster so they could show all the 1080i lines of incoming signal closer together, all within the displayed 16:9 image; in those TVs the black bars are dead space, the TV is not using vertical resolution lines for the black bars (as opposed to the 810i style). It is recommended that consumers verify how a 4:3 DTV handles 16:9 images before making a purchase.

1080i: HDTV format of 1080 interlaced visible lines of 1920 total pixels each in 16:9 aspect ratio. 1080i is per frame (540 lines x two fields) at 30 fps, and the HD format is commonly used since 1998. See DTV.

1080p: HDTV format of 1080 progressive visible lines of 1920 total pixels each in 16:9 aspect ratio. 1080p is per frame at either 24fps or 30 fps. 1080p/60fps is not one of the 18 ATSC formats. 1080p/24fps should be ideal for the transfer and broadcast of 24 fps film-based material, but it is not used at the present broadcasting. However, should it be used, objectionable flicker would require the 1080p/24fps to be converted to either progressive 1080p/60 fps or interlaced 1080i/30fps (60 fields per second).

If the signal were to be converted to the higher 1080p/60fps, it would also require a video projector with a fast raster (67.5kHz, double the 33.75kHz of 1080i/30fps) to been able to synchronize to the signal and display it as 60pfs. The same (fast raster) requirement would apply if the 1080p/60fps were obtained from line doubling a 1080i/30fps broadcast program using a scaler/line doubler processor. Some fixed pixel displays capable of 1080x1920 are not actually able to 'accept' a 1080p/60fps signal from an external source.

2-3 Pulldown (also mentioned as 3-2 pulldown): Technique used to display/transfer film based content to video. Film is shot at a rate of 24 frames per second, when projecting it on a motion picture theater screen any visible flicker is minimized by opening the film shooter twice for each frame, so viewers actually see 48 frames per second.

Interlaced video systems display at 30 frames per second (480i NTSC, 1080i HDTV); simply transferring each of the 24 film frames onto one video frame would result in a film running about 25 % faster than intended, this is solved by repeating some of the frames to restore the proper speed of the film on video. Telecine machines are used to transfer film to video to produce masters. They project film onto a video imager at 60 frames per second repeating film frames in a recurring 2-3 pattern.

Although DVD is a NTSC video media (480i/30 fps), content originated from film is actually stored as 480i 24 fps in the DVD to save space, with a flag inserted within the MPEG-2 data stream. When the flag is read it instructs a DVD player (or a 2-3 pull-down chip on other equipment) to repeat some fields to construct a 30 fps video sequence 'in real time', so a video display device can synchronize and display it properly. Video content (stored in DVD as video) does not need of this technique. Progressive players react to the flag in a different way.

A/D (Analog-To-Digital Converter): Electronic device that converts analog signals to digital. A D/A is also a similar device that performs the reverse function.

AC Line Conditioner/Surge Protector: Equipment that performs filtering of power-line noise/interferences on AC (alternate current), and protects the connected audio/video components from voltage surges and spikes. Some line conditioners are designed with separate sections to connect digital or analog equipment in two groups; the design claims that such separation blocks the feedback of digital equipment from interfering with analog equipment.

Active Lines: Visible lines of the horizontal scanning (on NTSC is 480i of 525i, on HDTV is 1080i of 1125i). Blanking and vertical sync signals are within the non-visible lines.

Active Subwoofer: Loudspeaker constructed to reproduce only low frequencies, with a power amplifier that is usually built within the speaker cabinet. Some subwoofers are 'passive', which means that the subwoofer requires a separate amplifier to drive the loudspeaker.

AES/EBU Interface: Connectivity standard for professional use established by the "Audio Engineering Society" and the "European Broadcasting Union" for digital audio transmission between equipment components. AES/EBU is carried on a balanced line terminated with three-pin XLR connectors. Sony/Philips' S/P DIF is the consumer adaptation of this standard.

Aliasing: (also called as flicker) Effect of a CRT electron gun drawing the scanning lines too slow, which gives time for the phosphors to fade.

Alternate Scanning: (also known as Interlace: i) Technique that displays a full frame of a picture by showing two different fields containing only half of the video information (such as 480i, 1080i).

Analog: (same as analogue) Continuous movement that takes time to change from one position to another. Standard analog audio and video signals have an infinite number of levels between their highest and lowest value, as opposed to digital that represent changes as only two steps ('on' or 'off', or binary's 'one' or 'zero'). Analog signals are stored magnetically, optical (films), and frequency modulated (Laserdiscs and VHS-HiFi).

Anamorphic: (also specified as Widescreen video 'enhanced for 16:9 televisions') Technique that improves the vertical resolution of widescreen video (number of horizontal lines in the vertical direction). The technique horizontally squeezes a wider 1.78:1 aspect ratio (16:9) image to a 1.33:1 (4:3) image, making objects look thin and tall, so when the image is unsqueezed by the display, the original widescreen geometry of the image is restored without reducing the vertical resolution lines.

This results in a gaining of 33% of vertical resolution compared to letterboxing with black bars (letterboxing takes away actual image content lines to show as black). In other words, a 16:9 image of 480i scanning lines would be shown with all its 480 lines, not as 360 of the letterboxed version (which discards 120 lines of image

content to create top/bottom black bars so a regular 4:3 TV can show the image as widescreen).

ANSI lumens: Method of measuring brightness by which the display device is divided into nine rectangles and light is measured from the center of each rectangle, then averaged among the nine and expressed as lux (lumen/square meter), which is then multiplied by the number of square meters of the image at the plane of meter reading. The result is the light output specification expressed in lumens.

Aspect ratio: The ratio between the width and height of the video image. Standard NTSC television has a 4:3 (1.33:1) aspect ratio, which is similar to the Academy standard for films before the 1950's, almost a square box shape. Widescreen screens are rectangular with a 16:9 aspect ratio (1.78:1); some widescreen display panels are only 15:9.

Widescreen sets are offered to the consumer in several flavors: front projection, rear projection, direct-view TVs, LCD TVs, and Plasma TVs. Some film aspect ratios are 1.85:1, anamorphic scope 2.35:1 or 2.40:1, and 65mm (70mm) from 2.05:1 to 2.21:1. Images from those wider aspect ratios are fitted within the 16:9 (1.78:1) HDTV image as a wider rectangle with top/bottom black bars (that use some vertical resolution lines of the 1080i or 480p DVD).

ATSC: Advanced Television Systems Committee, the federal committee that selected the new DTV standard, which the US adopted on December 24,1996 except for the full application of the 18 video formats described on the ATSC table III.

Automatic Convergence: Automatic alignment of red, blue and green color images.

Bandwidth: Range of frequencies that equipment for radio, TV, audio, and video operate and let pass-thru. The wider the bandwidth, the better the audio, or video quality. The higher the bandwidth, the better the performance of the equipment. In a digital circuit, bandwidth is measured as bits per second.

Baseband: Prime signal that is not modulated onto a carrier signal, but rather has its own path (composite, component, etc).

Bi-directional: Devices and ports that can let pass signals in both directions (such as RS-232, IEEE1394).

Black Level: (also known as brightness) Level of light produced on a video screen when it emits no light at all (screen black), the color NTSC system places the absolute black level at +7.5 IRE (unit of video defined by the Institute of Radio Engineers), a level that is higher than when the television was black and white, which set the absolute black level as 0 volts DC. The level was raised because B&W transmitters at that time could not handle a color signal with black level at zero volts.

Blooming: Effect that occurs on CRT images when the light hitting the screen is too high overdriving the phosphors (in CRTs) in a way that edges of images appear to exceed their boundaries, because brightness or contrast might be too high, dispersing the light to adjacent areas.

BNC: Professional type of connector with a cylindrical shape with pins that lock into place.

Brightness: (also known as black level) Intensity of light produced on a video screen, regardless of color.

Burn-in: Term given to the permanent damage on a video display caused when a fixed image has been shown for too long. CRT and PDP plasma panels are prone to burn-in; LCD and DLP chip-based displays are not. To reduce the risk of burn-in, some display devices shift the entire image just a few pixels at intervals, in a way that is not noticed to the viewer.

Usually manufacturers deliver displays with the contrast setting to its highest to increase the appeal of TV sets that stand out on fluorescent lighted showrooms. However, when you own the set it is always recommended keeping the contrast levels as low as possible until the display is properly calibrated, and to use stretching modes in 16:9 displays when viewing 4:3 images (to avoid long viewing with dark pillar bars).

Ceiling Surround channel/speaker: Format that uses a ceiling (height) surround channel/speaker decoded from the center front and center back channels, using an algorithm similar to what Dolby Pro Logic uses when extracting and steering to the center front the signal decoded from L and R fronts. One war movie already explored that format.

In the late seventies a similar technology was developed by ADS, Model 10 Acoustic Dimension Synthesizer, a comprehensive digital time-delay processor (and expensive at that time, almost $1000), the unit decoded a ceiling and center back surround channels/speakers in addition to the side/rear surrounds. After almost 25 years, the ceiling and back surround approach 'reinvents' itself.

CRT (Cathode Ray Tube): Vacuum tube containing an electron gun that drives an electron beam that rapidly hit a phosphor-coated screen and produce video images.

Center Channel: Channel that primarily carries the dialogue from a movie soundtrack, but also contains a substantial portion of other non-dialogue sounds. The center channel also helps maintain the front sound imaging for off-center viewers. Center channel speakers are magnetically shielded.

The use of TV's small speakers (and small TV amps) as alternative for a missing center channel is not recommended as a permanent home-theater setup. The dialog and much of the sound of a movie comes from the center channel, some have estimated it in the order of 60% of the movie soundtrack.

When using the TV's small amp/speakers in a home theater their loudness capacity would be exceeded much earlier than the external L/R speakers/amp (assuming that is larger than the TV audio, as typically is). The effect could be worst if the system does not have a subwoofer to redirect low frequencies from a small center and surrounds. The distortion on the center channel would affect the clarity of the dialog over loud passages.

Additionally, sounds that are panning side-to-side would have different timbre while switching among speakers (from left to center to right) accompanying the video

movement in that direction. Voices of people walking side-to-side will change their tone as they enter the TV's center speaker and as they depart from it, reason by which it is recommended for the center speaker to be of similar type and timbre than the L/R, and be driven by similar amplification as well.

Center Channel Input: Having this input in the DTV allows for the use of the internal speakers to reproduce the sound of the center channel in the home theater set-up. If the TV center channel input is line-level (RCA type), it can receive the center channel signal already decoded by an external surround processor, and use the TV set's internal amplifier to drive the internal speakers of the TV.

If the center-channel input of the TV is speaker-level, it can receive a speaker cable carrying an amplified center channel signal from an A/V Receiver or separate amplifier, bypassing the TV's internal amp. This may be useful if your audio/video system has insufficient space to place a center channel speaker, or you might want to start your surround system at a reduced cost. However, as mentioned in the Center Channel description, this approach should not be permanent.

Chroma: Sometimes called 'Hue', is the term used to characterize color information, such as hue and saturation (not black, gray and white). Interference of chroma can be seen as rainbow images and color transition dots, caused by the interaction between the chrominance and luminance components of a composite video signal.

Circle Surround: Multi-channel surround effect produced from two channel sources by using ambient information stored in a stereo recording, a stereo recording encoded for surround, and recordings specifically encoded in Circle Surround. The surround sound information sent to the surround speakers is stereo, as opposed to the monaural approach of Dolby Pro Logic. Circle Surround creates a believable front soundstage, apportioning the stereo signal more comfortably across the three front channels; this makes the system appealing for music listening.

Color Fringing: Artificial outlines surrounding the edges of colored objects on the video image.

Color Temperature: The correct color temperature of a video display should be 6500 degrees Kelvin, and expresses the color quality of a light source, which is bluer when the Kelvin measurement is high, and reddish when is low.

Comb Filter: This filter separates the luminance and chrominance from the composite video signal, improving, resolution, picture quality, and reducing objectionable color patterns. Low-to-mid-line sets utilize a glass comb filter. Higher-end sets utilize a CCD or digital comb filter, which greatly enhances resolution. The highest quality comb filters are 3D-Y/C digital comb filters, and may be motion-adaptive.

Component Video: Analog component video connections used typically for DVD players/recorders, HD-STB/PVRs, audio/video receivers, video switchers, D-VHS VCRs, and HDTVs are:

a) 3-wire 75 ohm coax analog YPbPr (YCbCr is actually 'digital' component video, and the nomenclature has been incorrectly used abroad for analog connections in consumer equipment), and

b) 5-wire RGB BNC or VGA 15 pin D-sub, with the horizontal and vertical sync signals separated from the other 3 signals. Component video connections do not carry audio, for which separate audio connectors are required, such as digital coaxial and optical (Toslink). Component video offers higher quality performance than composite and even S-video, it bypasses the composite en/decoding process, and color carrier frequency.

Composite Video: NTSC standard video connection (typically a yellowed jack/plug) for the passage of an interlaced video signal that has luminance (black and white information), chrominance (color), sync (horizontal and vertical), blanking, and color burst signals, all in one wire. The standard has been used also in VHS and laserdisc equipment. Regardless of the type of connection (component, composite, S-video) the use of gold plated jacks/plugs is known to offer better connectivity between them.

Contrast: Range between the maximum and minimum values of brightness; contrast ratio (CR) is a measurement obtained from the division of both. The specification came from the same panel of experts that established the ANSI lumens as the measurement of brightness in 1992 (under the American National Standards Association). A 'perceived' CR measured from an image as viewed would differ from the CR measured at the lens of the projection device (FPTV), and differ from the CR measured at the screen point.

Convergence: Alignment of the red, green, and blue CRT guns on a projected display device (RPTV or FPTV). Using the convergence controls of the TV, the three colors should overlap and display a white line on the crosshatch test pattern over the entire surface of the image. Display devices using fixed pixel arrays (such as DLP DMD chips) do not require convergence adjustments.

D/A: Digital to analog converter (the inverse conversion is also mentioned as A/D).

D-Sub: Name associated with the VGA connection with 15 pins for RGBHV signals.

DBS (Direct Broadcast Satellite): Satellite system that distributes signals from the satellite to the individual receivers, such as DirecTV, Dish Network, and Voom.

DCDi: Directional Correctional De-interlacing. Faroudja's proprietary name for their de-interlacing chip used now in many products.

Decibel (dB): (One-tenth of a Bel, named after Alexander Graham Bell) Logarithmic ratio used to measure power, sound pressure level, or voltage. A 3dB loss/increase is considered an attenuation/augmentation of half/double of its original value; zero dB is the threshold of hearing; 120dB is the threshold of pain.

Decorrelation: Technique used in THX processors for rear speakers to create an ambient DSP sound field similar in spaciousness and depth as a commercial theater.

Definition: Fidelity of the reproduction of a video picture, affected by resolution.

Deinterlacing: (or re-interleaving) Technique that involves assembling pairs of interlaced fields into one progressive frame (1/60 of a second long), and showing it twice, over the same amount of time as two fields. The need for 60 flashes on the screen each second stems from a biological property called the Flicker Fusion

Frequency, whereby the human brain needs to see a minimum number of single image flashes in a second to see motion without seeing flicker. See progressive scan below.

Digital Audio Inputs/Outputs: Audio jacks that can be either coaxial (RCA jack) or optical (Toslink) and allow for the passage of multi-channel digital audio signals over a single connection. There are other digital audio connections for multi-channel audio such as IEEE1394 (FireWire) used in some proprietary links between DVD players/Receivers/Processors, or the audio portion of HDMI. Digital connections are prone to less noise and interference than analog audio connections plus it keeps the signal in the digital domain.

DLP: DLP stands for Digital Light Processing. These projectors and rear projection televisions provide premium quality images with excellent black levels without the use of a CRT (Cathode Ray Tube). These projectors use a Digital Micro-mirror Device (DMD) to create images that are enlarged to fill the screen. The DMD chip has upwards of 1.3 million tiny mirrors to resolve 720x1280 HD resolution images.

In January 2004, the xHD3 DMD chip was introduced by Texas Instruments (TI, the manufacturer of DLP DMDs) that claims having resolution enough to resolve 1080x1920 HD images. Since this is a reflective technology, DLP will typically have higher ANSI lumens and Contrast Ratios than LCD. A color wheel is employed to help create a full palette of colors on one-chip projection implementations, which can produce a "rainbow" viewing effect for some people; three-chip implementation does not need a color wheel to show all the range of colors.

DNIe: Samsung's proprietary name for their video enhancement technology "Digital Natural Image" enhancement.

Dolby Digital 5.1 Surround: Multi-channel perceptual encoding scheme. Initially, Dolby's new surround system was called AC-3 (for audio coder 3). It was introduced in movie theaters in June 1992 as Dolby Stereo Digital (or Dolby SR). Dolby Surround is a single-band-limited surround channel with a range of 100 Hz to 7,000 Hz. Dolby Digital, on the other hand, offers a full dynamic range on five discrete main channels L, C, R, Ls, and Rs (20 Hz - 20,000 Hz), plus a separate .1 channel for Low Frequency Effects (LFE) intended to be reproduced by a subwoofer. The surround channels are in stereo (as opposed to mono with Dolby Pro Logic).

This format has been adopted as the audio standard for DTV signals. Perceptual encoding seeks to eliminate the data humans cannot hear, while maintaining all the information humans can hear, and was designed to encode multi-channel digital audio. It divides the audio spectrum of each channel into narrow frequency bands that correlate closely to the frequency selectivity of human hearing allowing coding noise to be very sharply filtered taking advantage of the psycho-acoustic phenomenon known as auditory masking. Coding noise stays close in frequency to the audio signal being coded. This effectively masks the noise.

AC-3 uses a "shared bit-pool" arrangement plus human auditory masking to make use of transmitted data as efficiently as possible, and allows multi-channel surround sound to be encoded at a lower bit rate than required by just one channel on a CD. Dolby Digital can process a 20-bit dynamic range digital audio signal over a frequency range of 20 Hz to 20,000 Hz +/- 0.5dB (LFE bass channel: 20 - 120 Hz

+/- 0.5dB) with sampling rates of 32, 44.1 and 48 KHz with a typical data rate of 384 kb/s (versus 1,411 kb/s for DTS) with a compression rate of 12:1.

The AC-3 algorithm was designed by Dolby to faithfully reproduce film and music based programs with interference-free discrete channels, not folded or matrixed like Pro Logic; whatever the director wanted to be hear from a specific area, it is the only thing that will be heard from that area. Dolby Digital is ported out of a DVD player of HD-STB via its digital coaxial or optical output and fed directly into the digital coax or optical jack of a Dolby Digital decoder/processor or receiver (with built-in DD decoder).

A decoder/processor has six separate analog audio outputs, one for each discrete channel of the 5.1 Dolby Digital, five to be amplified by a separate power amp, .1 LFE to be amplified by an active subwoofer. Dolby has enhanced the basic 5.1 format with EX (adding a matrixed back surround channel extracted from Ls/Rs as Pro Logic extracts the Center channel, and Dolby Digital Plus, a new format to facilitate broadcasters with a more efficient compression method for the DD audio in DTV transmission (more on both formats below).

Dolby Digital Plus: Format announced in April 2004 at NAB, for broadcasters to transmit 5.1 at 50% (192kBs) data rate of regular DD (384kBs). There will be a need to address backward compatibility issues with consumer's existing equipment; one idea was to make available conversion devices from DD+ to DD to permit consumer equipment to read as DD.

Dolby Digital Surround EX: Format of 6.1 multi-channel playback that provides a third surround channel (back) on Dolby Digital movie soundtracks encoded onto the left and right surround channels of 5.1 soundtracks. The format can be decoded by suited A/V receivers and Dolby decoders for playback over surround speakers located behind the seating area, while the left and right surround channels are reproduced by surround speakers to the sides.

To maintain compatibility, no information is lost when the film is played in conventional 5.1. The benefits of Dolby Digital Surround EX include more realistic flyover and fly-around effects, a more stable image for atmospheres and music, and a more consistent surround effect. No additional effect tracks are needed; the mixer directs the available sounds to the appropriate channels for greater directional precision.

Because the extra surround information is carried on the left and right surround channels, Dolby Digital Surround EX encoded soundtracks are still regarded as 5.1 soundtracks, although with respect to home playback, the terms 5.1, 6.1, and 7.1 mean that there are five, six, or seven main speakers, plus a subwoofer that still reproduces the LFE channel recorded on 5.1 soundtracks, plus any bass the main speakers cannot handle.

A 5.1-channel soundtrack can also be played on a 6.1- or a 7.1-speaker system, the two surround signals on the 5.1 soundtrack are spread across the three or four surround speakers by a Dolby Digital EX decoder, a THX Surround EX decoder, or other proprietary methods provided in home theater equipment by various manufacturers.

Dolby Pro Logic: Matrixed surround system with four channels of information (Left, Center, Right, and Surround) that are folded into two channels and encoded onto the L/R channels. The Pro Logic processor, in turn, extracts those four channels from the two encoded channels, and steers or directs them to the appropriate speakers, e.g. dialogue to the center channel and mono effects to the rear.

Under this scheme, the rear surround channel mono signal is divided over two speakers, which gives it more coverage. The rear channel information is derived by the simple formula of L-R with added reverb to give it a more natural like sound. The Pro Logic format concept helped originate the newer Dolby Pro Logic II, and IIx as follows.

Dolby Pro Logic II: Format that creates a 5.1 surround sound field from a two-channel stereo program material, whether or not it has been specifically Dolby Surround encoded. Encoded material, such as movie soundtracks, sounds more like Dolby Digital 5.1, while unencoded stereo material such as music CDs, sounds like a wider effect and more involving sound field. Pro Logic II provides two full-range surround channels, as opposed to Pro Logic's single, limited-bandwidth surround channel.

Dolby Pro Logic IIx: Format that works with 5.1 audio as well as two-channel material, producing up to 7.1 channels, by decoding center back and side surround channels from the left/right surround channels of Pro Logic II and 5.1 audio. Pro Logic IIx includes center channel width control and panorama mode, as well as music, movie and games modes. Dolby is positioning this format as an expansion of 5.1 audio with the option to extend it to 7.1 surround.

DTCP (Digital Transmission Content Protection): Scheme created for the purpose of copy protection of digital video transmitted over the 1394 connection. DTCP is also known as 5c for the five companies that participated on the standard (Sony, Toshiba, Intel, Hitachi, and Matsushita). The format allows for copy freely, once, and never, as options of protection.

DTS (Digital Theater Sound): DTS originated as a digital 5.1 surround scheme developed for the movies by MCA/Universal and Steven Spielberg. DTS was first employed in Spielberg's *Jurassic Park* in the summer of 1993. While it has not been around as along as Dolby, hundreds of films have been released with DTS encoded surround soundtracks. DTS Coherent Acoustics Coding (CAC) maps discrete 6-channel, 20-bit encoded data onto the 16-bit PCM digital audio stream, which is found on either a laserdisc or compact disc.

DTS' CAC signal is passed via the digital output (either coaxial or optical) present on many laserdisc, CD, and DVD players. While Dolby Digital uses perceptual coding to reduce the bit rate, DTS uses compression technology and the CAC algorithm with a higher bit rate than DD. The compression ratio is 3.75:1 of a 20-bit PCM digital audio stream with an eight times over sampling rate. It has a typical data rate of 1,411 kb/s (as opposed to 384 kbps of Dolby Digital). It performs transparently by coding 20-bit data at a bit-rate lower than 16-bit linear PCM.

The Coherent Acoustic Coding algorithm is a scaleable digital coding methodology, which operates on a multirate filterbank. It has been designed to filter the audio signal into frequency bands, which match the critical perceptual bands of the human ear. Within each frequency band, the signals are re-quantified at a variable

resolution. This is determined by the available bit-rate and an analysis of the long/short periodicity of the audio signal in each frequency band.

According to DTS, this allows an efficient sharing of the limited number of quantization bits without any transient pre-echo distortion. Furthermore, by coding the spectral analysis to extend and include all channels, the re-quantization routines are fed from a common bit-pool. DTS feels that this optimizes the coding performance and audio quality of each individual channel in a multi-channel format delivering a full-bandwidth for each.

Essentially, this allows six channels of transparent quality 24-bit recorded material at 48 KHz with less digital compression. While Dolby Digital uses a different approach of providing multi-channel sound with low bit-rates, the results might seem similar to the untrained ear.

Although the DTV standard does not include DTS as an audio alternative (only Dolby Digital), there have been discussions about including DTS in HD-DVD.

DTV (Digital Television): The DTV standard is composed of 18 digital formats grouped into two levels of quality, as approved by the ATSC (American Television Systems Committee) in 1995:

1) SD: Standard definition, 480i/p visible vertical resolution lines, with up to 704 total pixels of horizontal resolution, aspect ratio in 4x3 or widescreen 16x9, and

2) HD: High definition, 720p and 1080i/p visible vertical resolution lines, with respectively 1280 and 1920 total pixels of horizontal resolution, in widescreen 16x9 aspect ratio.

The FCC actually let consumer manufacturers implement compatible DTV tuners with the ability to receive/decode all the formats; the tuners would generally convert the signals to 480p, 720p, and 1080i, to match the native format of most monitors. Later in 2000, the Consumer Electronics Association (CEA) created another level in between SD and HD: ED (enhanced), which promoted the 480p format from SD to ED, among other changes (see 810i).

Our current NTSC over-the-air (OTA) TV system is 480i analog (actually 525i with 480i visible lines). Digital satellite and digital cable are equivalent to digital SD but they are also transmitting some of their channels in HDTV. To facilitate the transition broadcasters were given one extra channel slot from the FCC for the simultaneous broadcasting of the analog and digital versions of their programming.

It is a large investment for stations to build a DTV facility with new cameras, equipment, etc. When DTV is fully implemented, broadcasters have to return one of the two channels, analog over-the-air broadcasting will stop, and current TVs, VCRs, Tivos with analog tuners would stop tuning as well.

The DTV system implementation is mandatory; HDTV is optional. The implementation of DTV was originally planned by 2007, but the deadline has been conditioned to when 85% of the US population can receive DTV signals, discussions are being held in 2004 to determine if cable and satellite subscribers should be considered as part of the 85%, cable itself covers about 70% of the US population.

DTV Tuners: The ATSC (Advanced Television Systems Committee) selected 8VSB as the digital television standard for terrestrial (over-the-air) broadcast of HD signals in the U.S. All integrated DTVs have an 8VSB tuner, DTV monitors do not have one, and they need a separate HD-STB as a tuning device.

Under the five-year phased-in guidelines mandated by the FCC, over-the-air DTV tuners are to be added to 50 percent of sets measuring 36 inches and larger by July 1, 2004, and 100 percent by July 1, 2005. After that, 50 percent of sets measuring 25 inches to 35 inches are to add DTV tuners by July 1, 2005, and 100 percent by July 1, 2006. The rest are to conform by July 1, 2007.

The NCTA (National Cable and Telecommunications Association) chose QAM as the HD system for Digital Cable. Many 8VSB-integrated sets also include a cable QAM tuner to receive "in-the-clear" (unscrambled) cable signals, or a QAM tuner with Cable CARD for premium services.

QAM integrated HDTV sets introduced during 2004 have CableCARD tuners but are only unidirectional; in order to receive VOD, impulse PPV, and cable customized electronic program guide, CableCARD tuners have to be bi-directional, which means that owners of 2004 QAM integrated HDTVs w/CableCARDs might still need a second cable tuner (HD-STB) for the bi-directional features.

Dual Antenna Inputs: The existence of these inputs in the TV means that the set can accommodate two antenna sources, e.g. master antenna and cable-box or master antenna/cable-box and satellite receiver. By having dual inputs, antenna sources could be easily switched, rather than using external switching devices.

DVi: Also known as iLink 1394 digital connection for digital video cameras.

DVI (Digital Visual Interface): The DVI 1.0 specification was introduced in April 1999 by the Digital Display Working Group integrated by Silicon Image, Intel, Compaq, Fujitsu, Hewlett-Packard, IBM, and NEC to create a digital connection interface between a PC and a display device. It is a connection with enough bandwidth for uncompressed HD signals.

The 1.0 DVI specification is a point-to-point solution that supports video content but not audio. DVI standard cables have typically a five-meter distance limitation, although with better quality wiring, such as fiber-optic, higher distances are possible.

There are three types of DVI connectors:

DVI-I (integrated), carries a single or dual-link digital signal, with an additional analog signal for legacy devices.

DVI-D (digital) carries digital-only video data to a display.

DVI-A (analog) is available for legacy analog applications to carry analog signals to a CRT monitor or an analog HDTV (claims to be better than VGA).
DVI is being used as a secure connector for the passage of uncompressed digital video signals from HDTV receivers and other digital source devices such as DVD players, keeping all signals in the digital domain.

DVI is now found on most 2004 HD equipment and HDTVs. To protect content transmitted over DVI, the High-bandwidth Digital Content Protection (HDCP) scheme was created that provides a secure digital link between source and display, and does not allow for any recording of the digital signal. See HDCP. Additionally, HDMI has been aligned as the successor of DVI (see more below).

DVD Changer: Player capable of playing multiple CDs or DVDs. Changers fall into two categories. Simple changers rotary in type with up to five or six discs fitting into the rotary platter, or Mega-Changers that can hold a library of up to 400-discs within the confines of a single machine. Some brands allow several mega-changers to be tethered together allowing for vast libraries of movies and music videos.

DVD Recordable: There are presently three "re-writable" schemes for recordable DVD: DVD-RAM, DVD-RW, and DVD+RW. Depending on the format, DVD recorders will also record DVD-R or DVD+R ("write-once" recordable DVD) formats, which are reportedly playable on all standard DVD players. Several DVD recorders have been introduced since 2002 that are capable of playing/recording a combination of rewritable formats in one unit.

DVD/VCR Combo: Specialized machine that combines a DVD player with an integrated HiFi VCR into one cabinet. Designed for those users that want to "bridge the gap" from one video generation to another. There is also a TV/VCR or TV/DVD or TV/VCR/DVD Combo, which includes a television.

DVD-Audio: A typical CD is PCM encoded into 16-bit words at a sampling rate of 44,100 per second. DVD-Audio can use a variety of PCM resolutions, from multi-channel 24- bit/96KHz all the way up to 2-channel 24/192. Also included are sampling rates of 48kHz, 88.2 kHz, and 176.4kHz, as well as DTS and Dolby Digital data streams.

For better space utilization, some channels can be encoded with high resolution while others, like the surround, in lower resolution. A single-layer, single-sided DVD holds 4.7GB, enough for 40 minutes of six channels at 24/96. Six-channels of uncompressed 24/96 audio data require 13.8Mbps data speed while the DVD standard allows for up to 9.6 Mbps only, reason for which a lossless form of data compression was needed (Meridian Lossless Packing). MLP reduces storage and transfer-rate requirements by a factor of two without sacrificing quality (unlike "lossy" used on Dolby Digital and DTS).

Dynamic Range: Audio range expressed in dB measured between low-level noise and overload distortion; also defined as the range between the softer and loudest sound passages.

EDTV (Enhanced Definition TV): Additional level of DTV created in late 2000 by the Consumer Electronics Association (CEA) fitted in between the SD and HD levels. ED (Enhanced) is the naming convention to be used for display devices capable of 480p, previously part of the lower SD level.

External Speaker Jacks: Connections that allow the attachment of separate speakers directly to a TV for improved sound quality, or the attachment of rear speakers to experience surround. However, the low wattage of the internal television amplifier could become a loudness/performance limitation.

Faroudja DCDi Processing: Created by Faroudja, the DCDi technique is an additional improvement/upgrade to the 2-3 pull-down technique. It stands for Directional Correlational Deinterlacing, which according to Faroudja, provides for error-free deinterlacing of video originated sources such as sporting events. Reportedly, DCDi produces smooth, natural images by eliminating the jagged edges than can be seen on moving angled lines in video.

Front Projector: Video display device that is able to project an image on a reflective screen.

Gamma: Exponential function that expresses the non-linearity of the light output of a CRT (relative to voltage). The 'Gamma Correction' control in video monitors compensate for such non-linearity.

Gray-scale: Test pattern with shades of gray from white to black used to measure a monitor's ability to reproduce all the shades in an uniform manner and at the correct color of white (6500 degrees Kelvin). Gray is defined as equal amounts of red, green, and blue; white is the peak level of gray; sunlight is in the area of 5400 degrees Kelvin.

Harmonic Distortion: Distortion caused when audio equipment adds unwanted overtones to an original signal.

HDCP (High-bandwidth Digital Content Protection): Content protection system developed for DVI. The HDCP 1.0 specification was developed by Intel with contributions from Silicon Image in February 2000 to protect DVI outputs from being copied by providing a secure digital link between a video source and a display device. HDCP offers authentication, encryption, and renewability.

The Motion Pictures Association of America (MPAA) endorsed HDCP as the standard for the secure transmission of HD signals over DVI. Since the DVI signal is uncompressed (overwhelming for the digital storage devices of today) and protected by HDCP, HD recording over the DVI connection is not feasible.

HDMI: On December 9, 2002, the seven founders of HDMI (High-Definition Multimedia Interface) announced the 1.0 specification of this connectivity standard, the enhanced, more robust form of DVI. The seven founders are Hitachi, Matsushita, Philips, Silicon Image, Sony, Thomson, and Toshiba.

The standard supports HD uncompressed video, 8-channel digital audio (reportedly up to 192 KHz), and some control signals on a single cable (15 mm, 19 pin), while using less than half the available bandwidth. HDMI has the same video capacity as DVI, or up to five Gbps of bandwidth, double what a HD signal would require, and is backward compatible with DVI by using an adapter, although only for the video signal. The HDMI connector is smaller than DVI.

HDTV (High Definition TV): Level of DTV quality capable of 720p or 1080i vertical resolution, with a 16:9 aspect ratio and Dolby Digital audio. See DTV.

Horizontal Resolution: Not to be confused with horizontal scanning ('vertical resolution', which is the number of scanning lines of the television systems NTSC 480i and HDTV interlaced 1080i). Horizontal resolution is measured left to right, and has been traditionally specified as the number of transitions (TVL, TV vertical lines,

carried forward from the CRT analog age) in the horizontal direction measured up to the point equal to the picture height (75% or ¾ of the width of a 4:3 TV, 56% or 9/16 of the width of a 16:9 TV).

The horizontal resolution of a standard broadcast NTSC television is 340 TVL lines per picture height (450 edge to edge), DVD is 540 TVL (720 edge to edge), laserdisc is 425 TVL (567 edge to edge), and VHS is 240 TVL (333 edge to edge). Regarding HDTV the 'total pixel count edge to edge' for 1080i/p is 1920 horizontal pixels, and for 720p is 1280 horizontal pixels.

In the more modern age of fixed pixel displays such as PDP plasmas, LCD, DLP, LCoS, and DILA, horizontal resolution is generally expressed as the number of pixels measured in the 'complete' horizontal line, edge to edge (not TVL).

IEEE1394: 1394 is the short for IEEE1394. Digital interface conceived by Apple Computer in 1986, and it was called "Fire Wire" for its fast speed of operation. In 1995, the Institute of Electrical and Electronic Engineers (IEEE) adopted the serial bus as its standard 1394. Sony trademarked their name iLink for their implementation of the 1394 bus as a 4-pin connector.

HD signals are broadcast in compressed MPEG-2 format at approximately 19.4 Mbps. D-VHS VCRs and stand-alone HD-PVRs record MPEG-2 compressed HD signals, but only from a 1394 connection, which receives the digital data stream. HDTV monitors require a separate MPEG-2 decoder to decompress the signal for display, as oppose to DVI that is uncompressed.

To address security issues, a scheme called Digital Transmission Content Protection (DTCP) was developed for 1394 that works with MPEG2 compressed video. Mitsubishi implemented a 1394 network/control called HAVi for the passage of digital compressed signals between DTV equipment.

There are three types of cables used for 1394. A) A 6-conductor type that has two separately shielded twisted pairs for data and two power wires in an overall shielded cable with 6-pin connectors on either side. B) A 4-wire cable that uses two separately shielded data cables without power wires in an overall shielded cable with 4-pin connectors on either end. C) A conductor using either type of cable above, but with a 6-pin connector on one side, and a 4-pin connector on the other side of the cable.

The 4-pin connector is more common on digital video camcorders and other small external devices because of it's small size, while the 6-pin connector is more common on PC's, external hard drives due to it's durability and support for external power for 1394 peripherals.

Interlaced: Technique applied in television by which video images are send/displayed in two separate fields of lines that are merged together to complete one picture (frame). In the 480i NTSC and DTV formats, the 240 odd lines of one field are merged in an alternating mode with the other 240 even lines of the consecutive field, each field displayed at 1/60 of a second, and completing a frame of two fields in 1/30 of a second, fast enough for the persistence of vision to see them as they are all part of one single frame.

When NTSC was created in the 1940s, this technique was implemented to been able to efficiently fit and send images within the bandwidth transmission constraints. The NTSC system has 525i scanning interlaced lines of which 480i are visible; the same concept was applied to DTV digital 480i and 1080i formats, the 1080i format has actually 1125i lines, 45 of which are not visible.

Interpolation: Technique used in line-doublers to adjust for time differences in interlacing fields, to minimize 'jaggies', and improve overall picture sharpness. Some line doublers also interpolate calculated pixels between pixels on the horizontal line.

Invar: The invar shadow mask, found on direct-view CRT TVs, allows the picture to have more contrast level without risking long-term damage of the shadow mask itself. When the set's contrast is driven too high, a side effect called "blooming" occurs, to counteract this bleeding of colors, some manufacturers include the invar shadow mask, although still running the risk of burning the phosphors in the tube. A properly calibrated set would have the contrast level low enough not to need the invar (and the additional cost associated with it).

ISF (Imaging Science Foundation): Organization dedicated to promote the importance of properly calibrated display devices so they can perform to their full potential (NTSC or DTV). Training, calibration DVDs, and calibration professionals are offered by the organization to help consumers perform the necessary adjustments for their monitors to reach their best performance.

Keystone Effect: Effect that produces a picture that has one edge with a different dimension than the opposite edge, most usually produced by positioning the projector at a pronounced angle relative to the screen. To compensate for the distortion, some projectors have digital keystone corrections (horizontally and vertically), however, the correction could create other image problems. It is recommended to reduce the keystone effect by physically realigning the projector with the screen, so keystone correction adjustments are used as little as possible.

Lambert: Unit that measures the light intensity reflected off an object.

LCD (Liquid Crystal Display): LCD front and rear projectors use LCD panels to create images, which are then enlarged to fill a screen. The LCD panel uses two transparent sheets of polarizing material with a liquid containing rod-shaped crystals between. When a current is applied to pixel areas, those crystals align to create dark images. Panels do not produce color nor emit light; they are often side lit or backlit, and act as shuttles to selectively block off light and create images.

Three black and white panels are used, and the white light from the lamp is separated (via dichroic mirrors) into red, green, and blue beams. These beams are fed through the panels and then recombined to create the full color images. An LCD projector can provide rich colors and a good-quality picture, but some LCD projectors show a "screen door" effect.

LCoS (Liquid Crystal on Silicon): Type of projection HDTV that uses liquid crystals coated onto a silicon chip, which uses a reflective (aluminized) layer. As compared to standard LCD chips, this reflective design increases contrast, and eliminates any dotted "screen door" effect. Since it is a digital display device, LCoS technology also eliminates any chance of image "burn-in."

Lenticular Screen: Screen used in RPTVs with a surface designed to reflect maximum light over horizontal and narrow vertical angles.

Letterbox: Name used to describe the effect of viewing widescreen films or video wider than 1.33:1. To that end, black bars above and below the movie image are added to fill the 4:3 aspect ratio, to maintain the geometry of the original film (the aspect ratio chosen by the movie director). The 'anamorphic' method squeezes the image laterally when storing it, and the DTV monitor unsqueezes it when displaying it, which maximizes vertical resolution.

The letterbox technique wastes vertical resolution (horizontal lines) for the black content of the bars. When the film image is even wider than the 1.78:1 aspect ratio of a 16:9 TV (such as 2.35:1, 1.85:1, etc.) two letterboxing black bars are embedded within the 16:9 image itself, in such case a combination of anamorphic and letterboxing methods are used to minimize the waste of vertical resolution for black bars.

LFE (Low Frequency Effects): '.1' channel in Dolby Digital or DTS 5.1/6.1/7.1. The LFE channel contains low frequency effects in the range of 20-100 Hz intended to be reproduced by a subwoofer.

Line Doubling: Technique that stores in digital memory the horizontal scanning lines of each field of an interlaced video image, and then displays them both together at once, producing a picture that has twice of the original lines, and providing an appearance of improved resolution. HDTV sets typically perform line doubling of 480i NTSC images to display them as 480p.

Line Quadrupling: In addition to applying the line doubling technique, line quadrupling interpolates additional lines in between to fill the image with calculated pixels of information, providing an even better appearance and brightness. Line quadrupling requires a display device with a scanning rate of four times the normally required. Some display devices obtain the quadrupling effect by interpolating additional calculated pixels in the horizontal line (in addition to the doubling of lines). In such case, the display would just need a scanning rate for line doubling speed.

Lumen: Unit of measure used to express the amount of light emitted by a source.

Luminance: Signal that represents brightness in a video picture.

Lux: Unit to measure the amount of light per square meter taken at an illuminated surface.

MPEG-2: MPEG stands for the Motion Picture Experts Group. MPEG-2 is a video compression encoding/decoding method used in DVD, DBS satellite, and DTV to reduce the amount of data in the storage/transmission of digital video, by, for example, condensing redundant or repetitive image signals, or eliminating some picture elements.

Multiscan: Feature of some monitors that are able to automatically synchronize their scanning rate to a variety of signal scan-rates. Generally, HDTV monitors are able to synchronize to 480p and 1080i, and sometimes to even 720p.

Multi-Channel Analog Outputs: Set of six analog audio outputs designed to pass DVD-Audio and/or SACD aural information from the player to an A/V Receiver or A/V Processor.

Notch Filter: Filter that helps remove a small part of the signal that contains excess color information. By doing so, it helps eliminate some objectionable color effects from less than desirable signals. However, by utilizing the circuit, there is a slight loss in resolution of picture.

NTSC: National Television Standards Committee. Committee for the US analog color television video standard.

Overscanning: Effect that occurs when parts of an image cannot be viewed because they have been placed beyond the edges of the TV frame. The effect is caused when the TV scanning lines are adjusted to exceed the boundaries of the screen to hide the ruff edges of the image.

OTA (Over-The-Air DTV tuners): Also known as ATSC tuners. See DTV tuners

Pan-And-Scan: Technique used to transfer a widescreen movie into a 4:3 format with no black bars; the transfer operator actively searches and selects the 4:3 part of every widescreen image that contains important content in the movie. A 'Full-frame' 4:3 transfer not necessarily has been made with a Pan-And-Scan technique.

Pixel: The smallest element on a picture. Unit used to convey image/device resolution.

PIP (Picture-in-Picture): PIP allows you to view the active images of two sources simultaneously. For a monitor to perform this feature it requires receiving the images from dual tuners, or external sources that provide the images, or a combination of both.

POD: (Point Of Deployment interface) of the Host Interface License Agreement (PHILA) for cable tuners. Now called CableCARD.

Power: Not all power is created equal. For audio/video components to perform to their best the power should be well-balanced and clean of noise and interference, if the utility company does not provide clean power or your audio/video system is sharing electrical circuits with appliances or other devices that can degrade the power quality, it is recommended to install a separate electrical circuit for the audio/video system, and/or the use of an AC line conditioner/surge protector device (refer to the term further above in the Glossary).

Progressive Scan: Video format/technique that presents all of the scanning lines in the screen in one single pass from top to bottom, producing and image that has more resolution and brightness than its interlaced version. The 480p format, for example, requires the double of the transmission bandwidth and twice the monitor scanning raster speed of the 480i version.

Video that originates as 480p/60 fps is able to better follow fast action content producing much better results than 480i/30fps, and it even displays better than 480i line-doubled to 480p/60fps, because the image originates as 480p/60 fps at the

camera point. 720p is also considered more suitable to fast action content, such as sports, than the other 1080i HD format.

PVR: Personal Video Recorder (recording on internal hard drive, HDD), also known as DVR and Tivo.

QAM (digital cable tuners): Quadrature Amplitude Modulation. Digital modulation technique that calls for 64 and 256 QAM; using 64 QAM a cable channel that today carries one analog video channel could carry 27 Mbps of information, or enough for multiple video programs; using the 256 QAM, the standard 6 MHz cable channel would carry 40 Mbps. See DTV tuners.

Raster: Rows of dots scanned when producing a video image.

RCA-type Jacks: Standard connection used for analog and digital purposes. Composite video jacks are labeled yellow, and standard audio cables for left (white) and right (red) channels. RCA type jacks are also used for YPbPr component analog, Dolby Digital/DTS digital coaxial audio, Super-Audio/ DVD-Audio analog multi-channel, etc.

Resolution: Capability of a video device to reproduce (or an image to resolve) detail. The term is generally used to express horizontal resolution, as the number of lines/pixels that can be displayed in the horizontal direction (see horizontal resolution).

Retrace: Action of moving the electron beam from the end of one scanning line to the beginning of the next one. Usually associated with CRT type of display devices.

RGB: Red, Green, and Blue color signals (chrominance), primary components for color television; the primary colors of light. RGB video can be transmitted as: RGsB (the Green contains the sync signal), RGBHV (sync separate from colors, horizontal and vertical separate), RsGsBs (sync on each of the colors), and RGBS (sync separate from colors). See component video.

RMS (Root Mean Square): Measurement of continuous power output produced by an amp. The higher the RMS number, the cleaner, and louder (without distorting) the sound will be; one of the primary specs to base an amplifier purchase. Peak power ratings show the maximum wattage delivered by an amp during a brief burst during a musical peak.

Saturation: Term that expresses the purity and intensity of a color signal, and the extent by which it is free from white (less white more color saturation, less saturation results when adding more white to the color).

Scanning: Action of moving an electron beam horizontally and vertically across the raster in CRT video.

Scan Velocity Modulation (SVM): SVM adjusts the rate of horizontal movement of the beam as it "draws" the scan lines. Dark areas look larger over lighted background; lighted areas appear smaller over dark background. It is generally recommended to disable SVM on a properly calibrated monitor; one of the first things an ISF calibration job do is to find a way to disable SVM; look for a menu setting that is able to turn off SVM.

SDTV (Standard Definition TV): Lowest level of DTV that originally grouped the 480i and 480p formats together within that category (ATSC table III), see DTV. In late 2000, the CEA promoted the 480p to EDTV, leaving the SD level for just 480i digital.

Shadow Mask: Metal plate on a CRT device that helps the electron beam hit each individual phosphor by using perforated holes. See Invar.

Sharpness: Term to describe apparent focus and edge definition on video. Sharpness should be kept below the point at which extra edges are added to objects in the image.

Spatial Interpolation: Technique that calculates additions/removals of pixels in a digital image using weighted averages of information from adjacent pixels, producing a more transparent result with fewer artifacts. The technique facilitates the re-positioning or re-sizing of digital images.

Spatial Resolution: Number of pixels appearing on the entire video image (matrix of horizontal and vertical resolutions combined).

S/PDIF: Sony/Philips Digital Interface standard for digital audio connections (coaxial or optical TosLink). A consumer version of the AES/EBU digital transmission standard.

Special Picture Tube: Better grade of picture tube, such as either dark tint or dark glass picture tubes, which, by darkening the faceplate, provides greater contrast between black and white, although requiring an increase of brightness levels so that the picture does not appear too dark.

Other advancements include flat square tubes (FST) sometimes called "SuperFlat" or "FSTPerfect", which offers less distortion on the outer edges of the picture. Some manufacturers use special coatings to help cut down on glare and dust build-up giving the appearance of a richer picture, others use a combination of techniques to tweak out the highest performance from their picture tubes.

STB: Also mentioned as HD-STB, Digital set to box to tune DTV via OTA, cable or satellite signals.

Subwoofer: Loudspeaker designed and dedicated to reproduce very low frequencies (bass) from the .1 LFE Dolby Digital or DTS channel, and/or from the bass received from the other channels if their lower frequencies are crossed-over to the sub with a low-pass control. A subwoofer normally looks like a big black box. Since bass is non-directional, it can be placed anywhere in the room. Woofers range in size from about 5-inches to 18-inches in diameter with the majority falling in the 12-inch category.

Some of these enclosures are ported with a hole on the side or the bottom, which helps add a thump to the bass response.
Virtually any mid-line A/V Receiver or above has a subwoofer output jack on the back panel. This will attach directly to the L(eft) input of the sub. If the receiver does not have a separate subwoofer output jack, the left and right speaker outputs of the receiver can be connected into the appropriate left and right jack inputs of the

sub, then, the left and right speaker outs of the sub should be connected to the individual left and right speakers. In such case, the receiver crossover should be set as full range, and the sub's crossover hi-pass control should be set to send only the non-bass frequencies to the L/R speakers.

Verify the menu options of the receiver regarding not using the .1 LFE sub output, and to make sure it has a way to redirect the LFE effects to the main speakers (where the sub is connected). In either set-up, the lowest sounds are directed only to the subwoofer. Subwoofers are either active or passive. 'Active' subwoofers have internal amplifiers, 'Passive' subwoofers are less costly but require power from either the receiver or a separate external amplifier.

Super-Audio CD (SACD): Sony introduced Super-Audio (SACD) in the fall of 1999. Warner Music launched DVD-Audio in early 2000 with a coalition of hardware manufacturers such as Toshiba, Panasonic, Pioneer, and Meridian. Record labels wanted to prevent digital copying so the players would have only analog outputs; this means six cables for multi-channel playback, which also requires a receiver/pre-pro with six pass-through inputs.

When Sony acquired Columbia records it decided that CD quality was not enough for archiving the musical heritage, and invented a digital storage medium of high density (1 bit resolution sampled at 2.83MHz) called Direct Stream Digital (DSD), later used as an archival format and recording medium for the next generation of SACDs. The format was made able to record frequencies above 20KHz (the CD limit), which are inaudible but affect the audible range since they still modulate lower frequencies.

Dual-layer "hybrid" SACDs would contain the new format as well as the CD standard 16-bit/44.1 KHz "Red Book" (as published by Sony/Phillips) layer, which makes them backward compatible with CD & DVD players as well as on SACD players. The stereo tracks are a separate mix, not fold down from SACD multi-channels.

Surround: See specific details in Dolby Digital, Pro Logic, DTS, Circle Surround, etc.

Surround Speakers: Surround speakers are normally placed to the sides/corners above the listening area. Additionally another speaker may be positioned behind the listener as 'center back' for some formats, and even one on the ceiling. They carry directional effects (Dolby Digital/DTS) and/or just sound field enhancements (DD, DTS, Pro Logic, Circle Surround).

Speakers for discrete full-bandwidth surround formats such as DD/DTS should be able to handle full frequency response of 20-20 KHz and be sufficiently larger to handle loud passages (compared to the ambience purpose of Pro Logic for example). Rear speakers are either bipole or dipole design; dipoles produce sound from the rear and front, out-of-phase from each other (for which some people recommend them for surround); in the bipolar design the front and rear are in phase and sound equally.

There are different views regarding which type to use for music or movies, or for discrete and non-discrete surround formats, for directivity or dispersion, and for the type of room they are installed. Consult your audio store for your particular application.

S-Video (Inputs/Outputs): S-Video separates the luminance (Y) and chrominance (C) signals offering better picture quality and resolution than using standard composite/RF video connections. Use with S-VHS VCRs, and with other equipment as a second alternative to component video, if not present.

THX: License that identifies and certifies compliance with color and sound high performance parameters for home theater systems.

Timbre: Tonal characteristic of a sound determined by its harmonic structure.

Toslink: Fiber optic connection for digital audio developed by Toshiba.

Twitter: Type of flicker effect that occurs when white lines alternate within refreshing fields.

UHF (Ultra High Frequency): Subset of the television broadcast frequency that ranges between 470 MHz and 890 MHz. Most of the DTV broadcasting stations are currently using this band.

Underscanning: Effect caused by decreasing the horizontal and vertical raster size, allowing the four edges of an image to be seen into the screen, including skew and tracking (which should not be seen). See overscanning for a description of the opposite effect.

Vertical Blanking: Automatic action of turning off the scanning electron beam in a CRT while returning from the bottom to the top of the image to draw the next set of lines.

Vertical Resolution: Measurement in the vertical direction of the number of horizontal lines scanned from top to bottom to complete a picture frame. The NTSC system has 525i lines (with 480i visible), which includes TV broadcast/satellite/cable, laserdisc, VHS, and DVD. The ATSC DTV system includes three levels: 480i digital for SDTV, 480p digital EDTV, and 720p/1080i digital for HDTV, all visible lines.

Although not a broadcast format, HD also includes the 810i format of visible lines displayed within a 16:9 image when shown in some 4:3 TVs, as per CEA definition for HD updated in 2000. Vertical resolution should not to be confused with horizontal resolution, which is the number of lines/pixels measured left to right in the horizontal direction.

VHF (Very High Frequency): Subset of the television broadcast frequency that ranges between 30 MHz and 300 MHz. Some of the DTV broadcasting stations are currently using this band.

Video Compression: General name given to the methods used to reduce the digital data in a DTV signal (and DVD), such as MPEG-2, so the signal can be transmitted/stored within the allotted limited bandwidth/space. See MPEG-2.

White level: Level of the maximum picture brightness in TV, defining the range between the darkest and the lightest areas of the picture.

Y: Abbreviation for luminance.

Y/C: Y=Luminance, C=Chrominance (color). Nomenclature used for S-Video connections that separate both signals using 4-pin DIN connectors.

YPbPr: Analog component video connection with 3 cables. Also mentioned shorten as “component” on the report. Some component connections are only for 480p (DVD). HD enabled component connections should be specified as 720p/1080i or HDTV, otherwise, there might be a bandwidth limitation for HD signals, even when the connectors fit well.