The Status of HDTV in Europe Compared with other Regions

An industry viewpoint by Royal Philips Electronics

INTRODUCTION

The rapid development of digital technology and digital convergence has led to some remarkable advances in the quality of audio and video broadcast and in the consumer devices that bring sound and vision into the home. Chief among these advances is digital television, from which High-Definition Television (HDTV) was first researched more than 40 years ago.

More recently, the flat-panel display, using either LCD or plasma technology, has become commonplace, and flat-panel TV sets and PC monitors are now being mass-manufactured by the majority of major consumer electronics companies. While HDTV-capable, widescreen, flat-panel TV sets, employing multi-channel sound, are widely available and becoming more affordable, the number of broadcasters creating and transmitting HD content is still rather limited.

This paper discusses the deployment of HDTV in key selected countries both outside Europe and, in some greater detail, within Europe. What constitutes HDTV and its astonishing picture quality are explained in non-technical terms. Finally, it is highlighted how Philips strongly supports the case for HDTV in Europe, describing the customer benefits, the availability of ‘HD-ready’ products, emerging new and advanced video codecs and the company’s capabilities and credentials in digital TV, set-top box and semiconductor technologies.

MAJOR MILESTONE

If John Logie Baird, the Scotsman generally acknowledged as the inventor of television in 1926, were alive today he would be amazed at the advances in TV technology that have been achieved. What is also amazing, and not generally known, is that Baird also developed a 600-line color television system in 1941, which unfortunately never got beyond the experimental stage. In fact, color television did not become commercially available in Europe until 1967.

Since then, rapid progress has been made in TV functionality, picture size and quality, as well as in choice and number of programs transmitted by terrestrial, satellite and cable channels. Among the many milestones in television reached over the years, the most recent, enabled by digital technology, and probably the most spectacular, are the flat-panel displays, DVD recorder, and digital television that enables multi-channel reception, interactivity and many other features, as well as High-Definition Television (HDTV). No doubt, technical experts would suggest a number of others, but these three milestones, closely linked to each other, have the most impact on consumers and, literally, are the most visibly prominent.

While flat-panel displays, DVD recorders and TV sets are widely available and at affordable prices throughout the developed world, HDTV broadcast is not – at least, not in Europe. The main barrier to the deployment of HDTV has been the lack of sufficient bandwidth for satellite, terrestrial, cable and, especially, IP networks. In addition, there is a need to convince operators to allocate resources to HDTV at the cost of the numbers of channels they offer in Standard Definition TV. New and more efficient video codecs (see later in this paper) and attractively priced ‘HD-ready’ products are now available, which are encouraging operators and broadcasters to take the initiative and invest in HD technology.

Philips Consumer Electronics, February 2006_update draft 2
The initial ‘push’ is expected to be made by digital premium network operators, largely due to the cost of compelling HD content (especially considering recent movies and main sports events). In addition, it is expected that government initiatives in stimulating the transition from analog to digital in the free-to-air services domain will embrace HDTV in order to convince consumers.

HDTV – NOT YET EVERYWHERE
So, before we go into more detail about the European scene, it would be useful to look at the scenarios in some other parts of the world, from which much can be learned. In most cases, HDTV in the non-European countries discussed below were, up to recently, largely driven by government initiatives, some even mandatory.

USA – There is no doubt that the US has led the world in HDTV development. As far back as 1970, extensive research began into the feasibility of HDTV. However, without the availability of true HD broadcast it was hardly commercially viable. In addition, some of the systems proposed were hybrid analog/digital, whereas there were already discussions about the real future of HDTV based on true digital technology.

Nevertheless, the ground was set for the future, leading to the International Telecommunications Union (ITU) adopting an HDTV study in 1974, which acknowledged that HDTV should have a resolution comparable with 35 mm film and at least twice the horizontal and vertical resolution of existing television systems. In 1990, when the first digital terrestrial HDTV system was developed, it was realized that HDTV would eventually replace the existing US TV standard NTSC (National Television System Committee), which, with a 525-line system (compared to 1125 - 1080 lines for HDTV) left a lot to be desired in terms of resolution.

By this time only four R&D groups had proposed all-digital HDTV systems that were considered to be viable for further development. This led to the formation, in 1991, of a consortium known as the Grand Alliance whose objective was to combine the proposed systems into one, optimal HDTV system. The four groups are: AT&T/ Zenith, General Instrument, DSRC/ Thomson/ Philips and MIT. These Grand Alliance members, together with the FCC (Federal Communications Committee), certain broadcasters and CE and computer manufacturers agreed to adopt the ATSC (Advanced Television Systems Committee) standard for HDTV scanning formats. This standard has become widely adopted, for example in the USA and Korea.

Of the estimated 100 million TV households in the USA, about 10 per cent are HD-ready – an impressive number. Of these, cable dominates with 60 per cent, satellite with 24 per cent and terrestrial with 16 per cent.
This take-up is supported by increasing sales of HDTV sets where, in the last quarter of 2005, about 1.3 million were sold – an increase of more than 100 per cent from the same period in 2004.

The Consumer Electronics Association forecasts that 30 per cent of US households will be receiving HD broadcasts by 2007 – the year when the government has mandated that broadcasts to the entire nation will be 100 per cent digital. The CEA also projects that HDTV sets will outsell analogue TVs by 89 per cent in 2006, and that total unit sales will amount to almost 16 million, generating more that USD23 billion in DTV revenue. In the meantime, at least a dozen broadcasters are transmitting HD channels in major city areas. One example is DirecTV, which is expanding its high-definition and enhanced digital television programming offer to broadcaster CBS who transmits from New York and Los Angeles. The CBS-HD programming is available to eligible DirecTV customers in markets where CBS owns and operates stations, currently in about 20 cities.

Asia – In terms of population, and with an estimated 45 million TV households, Japan is close to the USA. At the end of 2005, Japan had 27 per cent of worldwide HDTV households, which means that more than 17 per cent of TV households in Japan are HD-Ready. Coincidentally, ten per cent of TV sets sold in Japan are HDTV. Current research figures show that terrestrial broadcast dominates with 45 per cent (7 HD channels), satellite with 30 per cent (18 HD channels) and cable with 25 per cent (no HD channels). Although the first broadcast of HD content in Japan took place in 1982, consumer take-up of HDTV was understandably slow because compatible TV sets only became widely available some years later.

In 2003, Korean consumers bought two million TV sets, of which about 30 per cent are HD capable. Of the 17 million TV households in Korea only one per cent receive HD content due to the low number of available channels. Even though cable transmission has 68 per cent of the TV market, no HD service is available yet. Terrestrial (22 per cent) and satellite (10 per cent) have very few HD channels, and set-top boxes for both are expensive (about USD 500) and are not subsidized. Culturally, because both Japanese and (South) Korean consumers are willing to spend money on TV entertainment and the latest technology, the potential for strong market pull is there, with eager CE manufacturers already providing the product push. China is not far behind its neighbors and, with its immense population gradually being able to afford more luxuries than, say, ten years ago, it is expected that the potential of HDTV is equally great.

Australia – Available figures show that 80 per cent of the seven and a half million Australian TV households have terrestrial transmission. There are five broadcasters that are mandated to transmit 24 hours of HD content per week, which is simulcast in SD (standard definition). In 2003, flat-panel TVs were about eight per cent of the 1.2 million TV sets sold, while of the 125,000 set-top boxes sold, 25 per cent were HD-capable. Of the 218,000 iDTVs and set-top boxes sold to retailers in the last quarter of 2005, 35 per cent were HD-Ready, twice the amount of the same period in 2005. Interestingly, pay-TV operators are not yet willing to provide HDTV services, presumably because of the high investment cost and that subscribers are unwilling to pay the extra premium.

THE EUROPEAN SCENE
As in other areas, more and more European consumers are buying LCD and plasma flat-panel TVs and PC monitors, for which prices are considerably lower than when they were first introduced about eight years ago. Now, having seen the quality of movies on DVD, viewers are expecting the same quality from broadcast TV.
Another driver of consumer demand for better picture quality is the dramatic increase of screen sizes, thus driving the demand for higher resolution. Screen sizes have been increasing since the transition from 4:3 aspect ratio to widescreen (consumers look at the screen height as the reference when buying their first widescreen television) and since the proliferation of flat-panel devices. Moreover, LCD panels make imperfections of SD signal quality more visible than CRT TV screens. All these factors contribute to consumer demand for HDTV.

Although many European broadcasters are committed to HD, not all are willing to invest in the higher (than analog or SD) shooting and post-production costs in the short-term. Because creating new programs in HD is more costly (at least double that of SD), only the largest broadcasters and content owners can afford to do so at present. In fact, only ‘box-office’ movies, major sports events and some documentaries have been shot in HD since about 2001. One example of a broadcaster that is doing so is the UK’s BBC, who sees the potential of not only the huge consumer pull in Britain, a nation with the highest concentration of digital (and interactive) TV, but also the prospect of sales of HD content abroad. One of the reasons for this is explained in the paragraph after the box below.

**WHAT IS HDTV?**

High-Definition Television (HDTV) is the highest quality format in digital television. HDTV provides improved transmission, better resolution and color and superb surround sound. It offers up to five times sharper picture quality than current standard definition TV sets and can be compared with 35mm movie quality on widescreen in cinemas. HDTV is also the first complete digital ‘end-to-end’ solution.

**Resolution**

Standard TV broadcast is with 575 viewable lines, while HDTV broadcasts with 1080 lines, resulting in a much higher resolution similar to that of today’s PC monitors that have 1024 x 768 or 1280 x 1024 resolution. In terms of number of pixels or picture elements, current analog TV sets display an image of about 400,000 pixels, while HDTV can display more than 2 million.

**Equipment**

HDTV reception requires an HD-ready TV set and an HD video source (usually via satellite, cable, terrestrial or IP set-top box, but not needed if the HDTV set has an integrated tuner or an HD-capable optical player or Media Center). A widescreen HD television set without an HD video source will only produce a larger picture of the same quality obtained on a standard television.

**Aspect ratio**

The aspect ratio is the width of an on-screen picture relative to the height. 16:9 is the aspect ratio for HDTV and widescreen format images. 16:9 is the format seen in cinemas today, while 4:3 is the aspect ratio of most standard analog and digital transmissions.

**Interlaced and Progressive scanning**

When video is interlaced (i), a single video frame comprises of two picture fields (half images). In the picture field only every other line is drawn (1, 3, 5, 2, 4, 6). If each horizontal line in a 1080i frame from 1 (as the top line) to 1080 (as the bottom line), each successive video frame alternates between drawing the odd-numbered lines and the even-numbered lines. Therefore, a display supporting a 1080i format may draw all of the odd-numbered lines (totaling 540 lines) in one frame, then draw the 540 even-numbered lines in the next frame. A display supporting 720 progressive (p) format will sequentially draw all 720 lines in each frame. Digital TV sets and PC monitors support both interlaced and progressive scan formats. HDTV sets support 480i, 480p, 720p, and 1080i. Progressive scan generally results in a superior picture than interlaced. HDTV sets using LCD or plasma flat-panel displays use progressive scanning.

**ATSC formats**

Standard-definition Television (SDTV) - ATSC signals lower than 480p (4:3 aspect ratio)  
Enhanced-definition Television (EDTV) - ATSC signals at 480p (16:9 aspect ratio)  
High-definition Television (HDTV) - ATSC signals at 720p or 1080i (16:9 aspect ratio)
An important factor in broadcasting HD content is bandwidth – HD requiring about four times more than SD. Bandwidth is less of a problem in satellite and cable networks, but even in these networks operators have to weigh up picture quality against the number of channels they offer. By their nature, terrestrial and IP networks have greater bandwidth limitations.

Moreover, it seems that European terrestrial broadcasters prefer to use the greater digital bandwidth to offer more services in SD, rather than create new programs in HD. This may change when the cable and satellite operators decide to offer HDTV more widely. In France, the government has mandated H.264 compression technology for the roll-out of pay-TV services over terrestrial from September 2005, which in practice means that these services may support HD.

Satellite has the greatest potential for HD signal transmission in Europe. One enterprising broadcast company already doing so in Europe is Euro1080. An initiative of Alfacam, based in Belgium and one of Europe’s leading TV facilities companies, Euro1080 was launched in January 2004 and is currently broadcasting two HD channels throughout Europe via the Astra 19.2° E satellite using MPEG-2 compression in the 1080i format. Its HD1 channel distributes documentaries, music and sports programs to European households, as well as to selected public places such as sports bars, hotels, restaurants, conference centers and airports. Euro1080’s HD2 Event Channel provides live or recorded programs to ‘event cinemas’ that allow viewers to enjoy large-screen projection with superb picture and sound quality. The HD5 channel, launched in August 2005, is time-shared with HD2 and is an HDTV demonstration and instruction service for retailers.

The first among the leading pay TV operators to offer HD broadcast was Germany’s Premiere, utilizing the breakthrough in compression technology offered by H.264, and which began to offer three HD channels (sport, movies and documentaries) from January 2006. The following large operator will be CANAL+ France scheduled for end March 2006. Several others have indicated or announced that they will also roll out HD in 2006. They include UPC, firstly in the Netherlands and later in other countries, France’s TPS, Sky Italia, Essent and Casema in the Netherlands. Joint promotion activities with Premiere, CANAL+ and UPC will start in the first half of 2006.

Philips plans to start delivering the ‘HD MediaSatPlus’ (STB) in the first half of 2006 to support the HD CANAL+ bouquet launch, and the ‘HD MediaSatPlus PVR’ set-top box with personal video recorder from mid 2006. BT in the UK may offer HDTV as part of their planned IPTV services.

An influencing factor for Europe to embrace HDTV is the migration from analog to digital broadcast on terrestrial, satellite and cable networks in the majority of countries by certain dates. For example, digital satellite TV in Germany is already more than 60 per cent of the retail market, while the city of Berlin was the first in the world, in August 2003, to switch to fully digital TV terrestrial transmission. Significantly, all 64 matches of the 2006 FIFA World Cup Germany™ football championship will be broadcast in HD by Premiere. The set-top boxes required to receive the HD transmission are being supplied to Premiere by Philips, and herald a joint marketing agreement between the two companies to promote the roll-out of HDTV in Germany. The 2006 FIFA World Cup Germany, for which Philips is an official category sponsor, is regarded as a strong incentive for broadcasters and operators to showcase the HD format. Obviously, if broadcasters will actually broadcast in HD depends on whether they have the resources and infrastructure in place to do so. Over the years, major sport events
have increasingly triggered breakthroughs in television technology, beginning with the introduction of color transmission and TV sets in 1967, then through various improvement steps in picture quality to the change from 4:3 aspect ratio to 16:9 (widescreen effect similar to cinema screen).

Other countries’ regions and cities are following suit progressively, with DTT trials taking place, backed by government and industry, until entire countries, like France, Germany, Italy, Spain, the UK and the Nordic group are fully digital. For some, this will take place as early as 2006 and later for others, up to 2012. In fact, it is forecast that 365 million TV households worldwide will be receiving digital signals by 2010, just over one-third of the total number of homes. More importantly, the number of households in Europe forecast to be able to receive HD transmission will rise from about 800,000 in 2006 (the ‘year’ of HD roll-out) to more than 4.5 million by 2008.

PHILIPS’ POSITION
The key criteria that consumers base their decision on when deciding to purchase a new TV are:

- picture quality
- design aesthetics (e.g. flat screen)
- screen size
- sound quality
- functionality

Of these, consumer research has shown that the first – picture quality – is the most important factor required by consumers in Europe, the USA and Asia. It is the feature most emphasized by Philips for many years in developing and manufacturing television sets and PC monitors, and accounts for the company’s huge success in sales of TV sets, monitors, DVD players and recorders and set-top boxes throughout the world. Proof of Philips’ leadership in picture quality is indicated by many awards from organizations such as EISA and Innovation. This is further supported by Philips’ strong influence and contributions to the CE industry with TV-related inventions such as 100Hz™, Natural Motion™ and Pixel Plus™, some of these attempted to be ‘copied’ by main competitors. Philips defines three selling points for digital TV: ‘Better’, ‘More’ and ‘Easier’, meaning superior picture and sound; greater program choice and more applications; and ease-of-use with self-explanatory and intuitive interfaces as well as integrated Electronic Program Guides.

Also key to Philips’ approach to the digital TV market is the Connected Planet vision of the future that allows people to enjoy digital content anywhere, any time, in the home and on the move, with the set-top box as the enabling gateway. Philips’ strong foothold in the four key technologies of digital video, storage, connectivity and display enable new, connected products matching the continuing move towards digital convergence.

Figure 2: Picture Quality – the chief factor for consumers when buying a new TV
Consumer perspectives

Philips has introduced many innovative picture-quality improvements over the years (see box on next page) that have been adopted almost universally by the TV industry. Two recent, major steps towards improved picture quality are the development of flat-panel displays and Pixel Plus. Together, they enable near ‘high-definition’ picture quality from standard TV transmission without the need for HDTV signals, achieved by upscaling an SD signal towards HD resolution. And, where HD can be received, Philips has even further improved resolution and picture quality with the recent introduction of Pixel Plus 2HD™ technology, already being incorporated in high-end HD-Ready Cineos FlatTV™ sets. Pixel Plus 3 HD™, announced at the CES show in Las Vegas in January 2006, creates the next step in brilliant and vivid colours as well as improving sharpness, detail and depth impression, and contrast.

Although these are major achievements and go a long way to fulfilling consumer expectations of perfect reproduction with maximum resolution, upscaled SD is not ‘true’ HD and still does not meet the astonishing quality of picture and sound that true HDTV brings. True HDTV means a true picture shot in HD and displayed on an HD-ready TV screen, whether from broadcast, pre-recorded DVD / Blu-ray™ or Internet sources. Moreover, the introduction of widescreen format and flat-panel TVs, where Philips has more than 20 per cent market share in Europe, has boosted the drive towards ever-larger screen sizes, in turn further impacting awareness of picture quality among consumers.

Providing a colorful element to the HD entertainment experience, Philips’ Ambilight™ FlatTVs are ideal for sports fans and design-discerning individuals. Launched in 2004 with single-sided ambient illumination, Philips’ Ambilight sets create a perceived better image and also widen the viewing area to ensure fans can see extended angles of each exciting play. Along with enabling sporting fans to immerse themselves in the action, Ambilight also adds a touch of sophistication to the design of any room. Using the remote control, consumers can turn the Ambilight feature on, even when the TV is off. Ambilight technology actively changes and matches each color represented on the screen. Later in 2004 Philips introduced dual Ambilight (left and right sides of the TV set), and announced the availability of four-sided Ambilight Full Surround at the CES show in Las Vegas in January 2006.

It is important for consumers to be aware of the connection requirements for HD between the HD-ready TV set and the digital set-top box required to receive the HD transmission. All Philips HD-ready TV products use HDMI (High-Definition Multimedia Interface) or DVI (Digital Video Interface) connections that maintain transmission in digital format. Philips HD-ready TV sets also accept equipment with YPbPr analog outputs. (See Glossary)

Broadcaster and operator perspectives

An encouragement to satellite broadcasters and operators who are considering making the transition from SD to HD, is the evolution of new, advanced video codecs, e.g. MPEG-4 Advanced Video Codec (AVC, or H.264) and Windows Media HD (WM9). These codecs require significantly less bandwidth than needed by MPEG-2, thus removing a major hurdle of bandwidth limitation that has long withheld operators and broadcasters from the move toward HD. The availability of the new codecs, especially MPEG-4 part 10 (H.264) – the one preferred by HD equipment manufacturers – coincides with the proliferation of large, widescreen flat-panel TVs, as mentioned above. Better bandwidth efficiency is causing less concern to operators with respect to sacrificing the number of SD channels to allow HD broadcast.
This presents a more attractive business incentive at the same time as relieving — to some extent — government pressure to accelerate digital switchover and the roll-out of HD itself.

An additional key driver of HDTV is the Blu-ray Disc™ (BD), a ‘next-generation’ of optical media that, with a 50 Giga-bit (double layer) version, offers about six hours of video in HD and up to 20 hours of SD. Moreover, BD supports data rates of up to 36 Mb/sec, far exceeding the HDTV data rate of 19 Mb/sec in MPEG-2, delivering the ultimate picture quality. Blu-ray is being developed by a consortium of 13 leading CE (one of which is Philips) and PC manufacturers. In the near future, high-definition content will become available via motion picture studios on packaged media, which will fuel the demand for HD-enabled displays. This will further drive the demand for HDTV broadcasting. Other applications in development for BD are high-capacity PC data storage and retrieval and next-generation HD video games, for example enabled by media servers.

An important issue for moviemakers, broadcasters and service providers is the protection of HD content against piracy and illegal distribution. New business models using High-Definition Content Protection (HDCP) solutions are emerging that show promise to effectively combat piracy (see box on EICTA Recommendations for HD Labeling). Philips has digital rights management (DRM) technologies in house and is deeply involved in finding effective DRM solutions to safeguard the interests of content owners and operators.

### Philips’ History of Innovation in Picture Quality

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<thead>
<tr>
<th>Year</th>
<th>Innovation</th>
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<tbody>
<tr>
<td>1988</td>
<td>Introduction of the first 100 Hz TV set by Philips</td>
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<tr>
<td>1992</td>
<td>Addition of Widescreen, Digital Scan and DNR</td>
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<td>1993</td>
<td>Addition of Black Stretch</td>
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<td>1995</td>
<td>Addition of Natural Motion (1st generation motion estimation)</td>
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<td>1996</td>
<td>Addition of Auto Format</td>
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<td>1998</td>
<td>Introduction of FlatTV</td>
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<tr>
<td>1998</td>
<td>Addition of Digital Natural Motion</td>
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<tr>
<td>2000</td>
<td>Introduction of Real Flat CRT</td>
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<td>2002</td>
<td>Addition of Pixel Plus in CRT</td>
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<tr>
<td>2003</td>
<td>Addition of Pixel Plus in FlatTV and Cineos</td>
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<tr>
<td>2004</td>
<td>Introduction of Pixel Plus 2 in FlatTV</td>
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<td>2005</td>
<td>Introduction of Pixel Plus 2 HD in HD-Ready Cineos FlatTV</td>
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<tr>
<td>2006</td>
<td>Introduction of Pixel Plus 3 HD in HD-Ready Cineos FlatTV</td>
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Philips is a pioneer in both analog and digital TV technology and an active member of key industry standards organizations, including pioneering work in defining the ATSC standard for HDTV scanning formats. Also, the company already has an impressive range of ‘HD-ready’ flat-panel TV sets and ‘HD-TV’ peripheral products on the market, and is now labeling its HD-capable Flat TV product range in this manner through the use of the EICTA-recommended logos (see logos and box below). By the beginning of 2006 more than 90 per cent of Philips’ European range of large-screen FlatTV sets was so labeled.
These credentials, strengthened by long-standing relationships and co-operation with broadcasters, network operators, service providers and governments in numerous countries, makes Philips one of the few global companies in a strong position to take a leading role in the further development and roll-out of HDTV in Europe. In this context, Philips calls on broadcasters and other content owners to take the step of investing in the production or purchase of HD programs, to ensure capturing consumer interest. More importantly, the company strongly urges the formation of a clear and unified pan-European policy on HDTV that will stimulate its adoption within the entire broadcast value chain.

Philips' strategy for HDTV is most strongly based on picture quality and positioning as a major electronics player appealing directly to the consumer and retail outlets, rather than on the HD technology itself. This will also help boost sales of large-format, widescreen, flat-panel displays and TV sets and related HD devices in a highly competitive market. Philips is also able to leverage its brand name and experience in set-top boxes, and media servers to gain retail market share for both DTV and HDTV products.

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### EICTA Recommendation for HD Labelling

The European Information, Communications and Consumer Electronics Technology Industry Association (EICTA) was set up by the European Commission with the primary objective of accelerating industry growth in the European Union. EICTA has recently drafted a recommendation for HD labelling. The recommendation follows the current agreement among CE members of EICTA who have considered the ideal criteria for HD-compatible display devices that will be ready to accept baseband High-Definition input signals. EICTA recognises that HD sources will likely be intrinsically of higher content value than existing SD sources, and therefore require a higher level of content protection. It is expected that a digital interface (either HDMI or DVI) in conjunction with HDCP will be demanded by content rights holders.

The minimum requirements for devices to carry either the ‘HD ready’ or the ‘HD TV’ logos can be downloaded from the EICTA website (see below)

Rudy Provoost, CEO of Philips Consumer Electronics, was appointed President and Chairman of the Executive Board of EICTA in August 2004. (For further information on EICTA, go to www.eicta.org).
IN SUMMARY & A GUESS AT THE FUTURE
The many factors discussed in this paper are sure signs that HDTV is inevitable, both as
the successor to analog TV and as a logical development of Digital TV. Philips foresees
that HD will take off in 2006 on a large scale, with operators taking the incentive in a
competitive environment that creates differentiation or where free-to-air TV services are
available, underscored by the HD broadcast of the 2006 FIFA World Cup Germany
soccer matches in most main countries in Europe. When this happens operators will take
the lead and make more efficient use of bandwidth, enabled through the new codecs for
which silicon technologies are now available. In fact, Philips Semiconductors has
developed global chip solutions for set-top boxes and TVs, which are suitable for the
USA and Europe. These solutions are based on the company’s Nexperia™ flexible
architecture platform.

With an illustrious past, going back more than 100 years, Philips, is a world leader in
consumer electronics, with a wide range of superior products, including ‘HD-ready’ TVs
and peripherals. This, with a proven track record in semiconductor and digital broadcast
technologies, backed by considerable research facilities and active membership in
numerous standards bodies, qualifies Philips as both a major force in driving HDTV and
a prominent player in its roll-out. With such strategies and innovative solutions as its
Connected Planet and Ambient Intelligence concepts, the Nexperia multimedia
processing platform and wireless connectivity offering, the company is certain to succeed
in improving the quality of life among millions of consumers all over the world.

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About Royal Philips Electronics
Royal Philips Electronics of the Netherlands (NYSE: PHG, AEX: PHI) is one of the
world’s biggest electronics companies and Europe’s largest, with sales of EUR 30.4
billion in 2005. With activities in the three interlocking domains of healthcare, lifestyle
and technology and 159,200 employees in more than 60 countries, it has market
leadership positions in medical diagnostic imaging and patient monitoring, color
television sets, electric shavers, lighting and silicon system solutions. News from Philips
is located at www.philips.com/newscenter.
HDTV GLOSSARY

AC-3 - The 5.1-channel sound system known as Dolby Digital. AC-3 delivers CD-quality digital audio and provides five full-bandwidth channels for front left, front right, centre, surround left and surround right speakers, plus subwoofer, for a total of 5.1 channels.

Dolby and the double-D symbol are registered trademarks of Dolby Laboratories

ATSC - the Advanced Television Systems Committee in the USA, responsible for developing and establishing digital and HDTV standards, adopted by most countries in the world.

Addressable Resolution - The highest resolution signal that a display device (TV or monitor) can accept. Note: although a particular device (Digital or HDTV) is able to receive the resolution, it may not be capable of displaying it.

Aspect Ratio - Refers to the width of a picture relative to its height. Most analog TV sets have an aspect ratio of 4:3 aspect ratio. HDTV has a 16:9 aspect ratio.

ATV - Advanced Television is an earlier term used to describe the development and advance applications of digital television, now referred to as DTV.

AVC - Advanced Video Codec that significantly reduces bandwidth requirement.

Bandwidth - A range of frequencies used to transmit information such as picture and sound. For TV broadcasters in the USA, the Federal Communications Committee has allocated 6 MHz for each channel. For DTV in the USA, the maximum bit rate possible within the bandwidth is 19.4 Mbps, which is one HDTV channel. SDTV has a lower bit rate, therefore the bandwidth can accommodate more than one channel. In Europe there are no public regulations available yet.

Bit Rate - Measured as 'bits per second', and used to express the rate at which data is transmitted or processed. The higher the bit rate, the more data that is processed and, typically, the higher the picture resolution.

Channel - In the USA, a 6 MHz (bandwidth) section of broadcasting spectrum allocated for one analog NTSC transmission.

Component Video Connection - The output of a video device (such as a DTV set-top box), or the input of a DTV receiver or monitor consisting of 3 primary color signals: red, green, and blue that together convey all necessary picture information. With current consumer video products, the 3 component signals have been translated into luminance (Y) and two color difference signals (Pb, Pr), each on a separate wire (YPbPr).

Composite Video - An analog, encoded video signal (such as NTSC) that includes vertical and horizontal synchronizing information. Since both luminance (brightness) and chrominance (color) signals are encoded together, only a single connection wire is needed.

Compression - A method of electronically reducing the number of bits required to store or transmit data within a specified time or space. The video industry uses several types of compression methods but the method currently adopted for DTV is mostly MPEG-2.
Four full-range channels of programming and data can be compressed into the same space required by a single analog channel. New codecs are even more efficient, notably MPEG-4 part 10, also known as H.264.

**DTV** - Digital Television. Refers to all formats of digital television, including high-definition television (HDTV), and standard definition television (SDTV).

**Downconvert** - A term used to describe the format conversion from a higher resolution input signal number to a lower display number, such as 1080i input to 480i display.

**EPG** - Electronic Program Guide. An on-screen display of channels and programs data.

**HDMI** - High-Definition Multimedia Interface. HDMI is an industry-supported, uncompressed, all-digital interface for interconnecting any compatible digital audio/video source, such as a set-top box, DVD player or A/V receiver, and a compatible digital audio and/or video monitor, such as a digital TV.

**HDTV** - High-Definition Television. The generally agreed upon definition of HDTV is approximately twice the vertical and horizontal picture resolution of today's TV, which essentially makes the picture twice as sharp. HDTV also has a screen ratio of 16:9 as compared with most of today's TV screens, which have a screen ratio of 4:3. HDTV offers reduced motion artifacts, and offers in the USA - multi-channel - 5.1 independent channels of CD-quality surround sound.

**Interlaced Scanning** - In a television display, interlaced scanning refers to the process of re-assembling a picture from a series of video signals. The standard NTSC system uses 525 scanning lines to create a picture (frame). The PAL system uses 625 scanning lines. The frame/picture is made up of two fields; The first field has 262.5 odd lines (1,3,5...) and the second field has 262.5 even lines (2,4,6...). The odd lines are scanned (or painted on the screen) in 1/60th (1/50th for PAL) of a second and the even lines follow in the next 1/60th (1/50th for PAL) of a second. This presents an entire frame/picture of 525 (or 625) lines in 1/30th (or 1/25th) of a second.

**Letterbox** - The term used to describe the way a 16:9 aspect ratio image is displayed on a 4:3 screen, where black areas are visible above and below the image.

**NTSC** - National Television Standards Committee in the USA responsible for developing standards for 'traditional' analog TV, prior to digital TV and HDTV.

**PAL** - Phase Alternation Line. A signal format used in video equipment in Europe and parts of Asia. PAL signals provide 25 frames per second, and are not compatible with NTSC.

**Pixel** - Term used for 'picture element', the smallest element in a television picture. The total number of pixels limits the detail that can be seen on a television. A typical television set has less than half a million pixels. The pixel count for HDTV is nearly two million.

**Progressive Scanning** - In progressive scanning, typically used by VGA computer monitors, all the horizontal scan lines are 'painted' on the screen at one time. Adopted DTV formats include both interlaced and progressive broadcast and display methods.
Resolution - The density of lines and dots per line, which makes up a visual image. Usually, the higher the number, the sharper and more detailed the picture will be. In DTV, maximum resolution refers to the number of horizontal scanning lines multiplied by the total number of pixels per line, called pixel density.

SCART - Syndicat des Constructeur d’Appareils Radio et Télévision is the European standard audio/video connector.

SECAM - Système Electronique Couleur Avec Mémoire is a signal format used in video equipment in France and the former Soviet Union. It is incompatible with PAL and NTSC formats.

SDTV - Standard Definition Television, refers to digital transmissions with 480-line resolution in the USA and 576 in Europe, either interlaced or progressively scanned formats. SDTV offers significant improvement over today’s conventional PAL picture resolution, similar to comparing DVD quality to VHS, primarily because the digital transmission eliminates snow and ghosts, common with the current analog format. However, SDTV does not come close to HDTV in both visual and audio quality.

Upconvert - The term used to describe the conversion of a lower apparent resolution to a higher number, such as ‘upconverting’ 720p to 1080i. This is a misnomer, though, since to accomplish this, the horizontal scanning frequency is actually lowered from 45 kHz to 33.75 kHz. Resolution quality is not improved by this method.

YPbPr - A method for interconnecting decoded video data. Generally used for a digital TV signal source. The video signal is separated into its component parts of brightness and color differentials. The latest connection standard is HDMI (see above)

YUV - Also sometimes referred to as YCrCb, where a video signal is separated into components of brightness and color.