

DENSITIES

Densities is a publication from Philips Electronics, Co-ordination Office Optical & Magnetic Media Systems, Eindhoven, The Netherlands, Tel.: +31 40 734682 Fax: +31 40 732113.



REPLitech Applauds MMCD

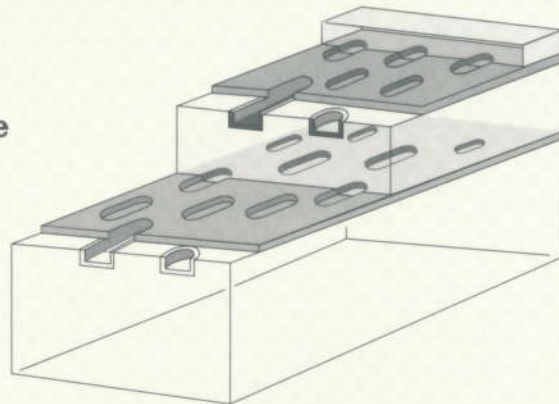
Visitors from all over the world to REPLitech, the world's leading conference and exhibition of the replication industry for all types of media, were impressed by demonstrations of MMCD.

Sony and Philips staged a three-day permanent show of the new system and confided in visitors with the ins and outs of MMCD disc manufacturing. "Impressive and convincing, when can we start?" one visitor exclaimed. Parallel sessions devoted specifically to the Digital Video Disc (DVD) were held with representatives of both camps,

MultiMedia CD and SD. In the general session, speakers explained the ins and outs and pros and cons of the new platforms.

Warren Lieberfarb, President of Warner Home Video, and initiator of the SD format, expressed his conviction that the SD is the best option to choose as successor format to the current CD.

Bud O'Shea, an independent media industry consultant, however, explained why he thinks that MultiMedia CD is the way to go.



The Dual-layer construction.

Key Issue

Bud O'Shea views the developments from the perspective of the end-user. "The consumer's perspective is the key issue that must be addressed before any new technology can be declared a success," he states.

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REPLitech

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MMCD Disc Trial Runs Successful

3M, DADC and PolyGram announced that the trials with the new MMCD on their standard production lines have been successfully completed. This was the big news at the REPLitech conference held in Santa Clara, California, June 13 - 15, 1995.

Thousands of samples produced by PolyGram's plant at Hanover, Germany were handed out as replicas to attendees at the event. Company spokesmen confided that the start-up had been extraordinarily successful. In fact experiences were more promising than anticipated. Only a few problems occurred when adjusting the standard Audio CD

manufacturing process to MMCD. Yields are satisfactory at this stage and the technical specifications of the discs are within the tolerance ranges laid down by Sony and Philips.



An MMCD sample as distributed at REPLitech.

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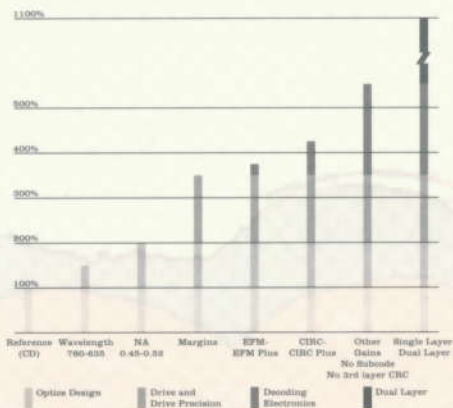
Continuing story of page 1.

He raises the question whether the new technology fulfils a need in the market. "In this era of multimedia and information superhighway new technologies cannot merely address today's needs. Instead they must be resilient and flexible enough to also anticipate the consumers' needs for tomorrow. Consider this in the context of the new high density media. They provide ten times the storage capacity of standard density discs today. The MMCD's increased capacity is essential to meet the needs of motion-picture studios, who will soon be offering home theatre enthusiasts a high quality, full length motion picture on one single-sided, five-inch disc" he continues.

"The increased disc capacity also benefits PC users, because more than ninety percent of all CD-ROM titles sold today require greater capacity than is currently available

on standard density CDs. The increased data capacity also offers a number of benefits to game enthusiasts, including faster performance, high quality full motion video, richer graphics, better sound and even 3D animation. And all this can be stored on a single disc, rather than two or three discs, typically required today.

Music enthusiasts will also benefit



from this high density media in the future. MMCD has capacity to store multi-channel digital recordings or even more realistic stereo sound.

And last but not least, consumers will experience these new benefits at their own pace, in a non-intimidating environment. The reason for this is that the MMCD hardware provides full backward compatibility. In other words they will play the billions of music CDs, Video CDs, CD-is and CD-ROMs that have already been purchased" he adds.

REPLitech

Industry Support

"The second question is whether the system enjoys industry support. And in particular support of the so-called "content providers". For as history has shown over and over again, new technology without the proper content support is merely new technology for its own sake.

Clearly, the new technology will be supported by Motion Picture Studios for digital video disc applications. According to the trade magazine Variety, the major Hollywood studios already have a combined library of nearly 14,000 movie titles to offer consumers. And in the PC industry, more than 5000 CD-ROM titles were introduced in the US in 1994 alone" Bud reveals. The new MMCD media should also prove popular with the music industry, which is now aggressively embracing multimedia and interactivity. CD-ROM, Video CD and CD-i titles have been released from a variety of innovators, from The Cranberries, Bob Dylan, Peter Gabriel, The Rolling Stones or Prince, to U2. And high density discs are also bound to play a role in CD Plus, Continues on page 3.

Companies endorsing MMCD

- 3M Corporation
- Acer
- Aiwa
- Alps Electric
- Aztech
- Bang & Olufsen
- DADC
- Gateway 2000
- Grundig
- JVC
- Lion Optics
- Magnavox
- Marantz
- Mitsumi
- NEC
- Nokia
- ODME
- PDO
- Philips Electronics
- Polygram Filmed Entertainment
- Ricoh
- Sony Corporation
- Sony Pictures Entertainment
- Teac
- Wearnes Peripherals

No Dual-layer SD Show at REPLitech

Visitors to REPLitech held last month in Santa Clara, California, were faced with a disappointment. The event was flooded with literature and brochures by the SD high density disc alliance.

Eyebrows were raised when visitors wanted to see the dual layer SD system in operation in

order to compare performance with MultiMedia CD. Although a low key demonstration of a single layer SD was staged, dual layer performance was presented on video tape only. This was quite a disappointment for many visitors. MMCD, on the other hand, was demonstrated constantly to large audiences, in both single and dual layer versions, during the full three days of the conference.



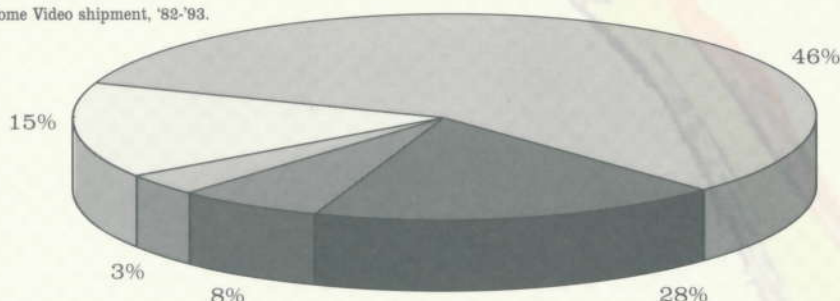


Continuing story of page 2.

the multi-session CD, which is compatible with Audio CD players as well as multimedia PCs and CD-i Ready discs. These CDs show song lyrics, video clips, artist biographies and album discographies.

The medium allows the industry to create a completely new generation of entertainment and information products that will excite and inspire consumers in ways never thought possible before.

Home Video shipment, '82-'83.



Innovative Motion Picture Products

"The dual-layer, single-side technology will allow studios to distribute their product more cost effectively, because a movie can be released in both normal and wide screen aspect ratios. Both picture images can be stored in separate layers on the same disc, for example. Even the longest epic-length motion picture can be played back without interruption, again from a single-sided disc. Consumers will be able to purchase a movie with scenes shot in two versions.

For instance Parental Guidance rated films for viewing with their children and R-rated for viewing by themselves, after the children have been tucked in bed at night" he says.

"In addition, new marketing opportunities will become available. Film buffs will be able to purchase their favourite motion picture, along with its sequel.

A movie could even be sold with its own interactive game stored on the same disc. Now is the time for each of us as hardware manufacturers, content providers and replicators to face the challenges high density CD create, so that we can determine the industry's success in the future" he urges.

Another Perspective

Mark Anderson, General Manager of PDO Media, Stillwater, Minnesota, put another perspective to the arrival of MultiMedia CD. MMCD is the answer to the expectations of various groups and factors in the market. MultiMedia CD provides utility, compatibility, manufacturability and profitability. The two versions of MMCD provide solutions for both computer software and motion picture producers. The format has been developed to respond to the

specification defined by the individual members of the Motion Picture Studio Advisory Committee. Ninety five percent of all movie applications are met by the basic single layer version of the MMCD, which can store up to 135 minutes of motion picture and relevant additional information.

The remaining five percent of extra long playing time blockbusters will be catered for by the dual layer version.

Compatibility is a highly desired feature of the market. Consumers don't want their current libraries to become obsolete. If compatibility is provided with actual technology, acceptance will be much quicker than with a completely new non-compatible system.

Replicators' Capital Investment Protection

The same goes for the replication industry. If this industry can manufacture MMCD discs on the same, slightly modified equipment, large volume output will be achieved much quicker. MMCD discs are mastered in the same way as the Compact Disc. Depending on the age and type of system, some minor changes may be necessary. Since specifications are more advanced, a tighter process control needs to be maintained. The higher capacity requires smaller pits, as small as 0.3 microns. A more sensitive photo-resist will allow steeper pit angles, better control of pit size and contours and provides better SNR performance.

Single layer discs require just the same moulding process as current CD products.

That is, the same optical-grade, environmentally-stable, low-cost polycarbonate resins, 25 - 70 ton presses in use today, one disc per moulding cycle, and no compound yield loss caused by assembling independently made parts together. The protective layer and label are identical to those in use now. The dual layer technology adds no new science or parallel processes. It requires some additional testing and diagnostic devices to control the more advanced nature of the product. Add to this four more steps in the production process sequence, and the best return on investment becomes a reality. Low additional investment, no risk, big additional business and high pay-back are the business parameters for replicators and MMCD.

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Events Calender MMCD promotions*

IFA	Berlin	27 August - 5 September 1995
Audio Fair	Tokyo	11 - 15 October 1995
Japan Electronic Show	Tokyo	17 - 21 October 1995
REPLitech Singapore	Singapore	24 - 26 October 1995

* All data subject to modification without notice

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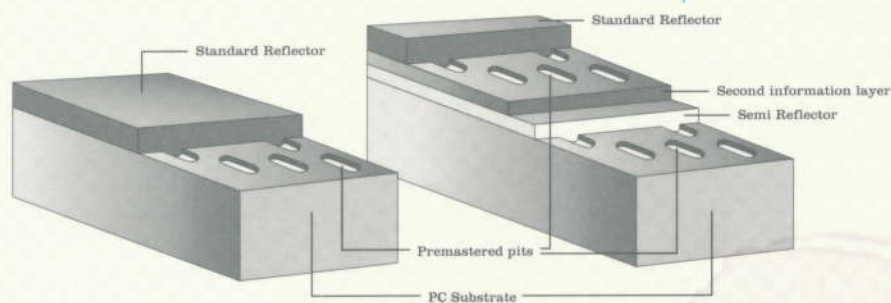
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The Making of MultiMedia CD discs

The disc configuration of a single layer, high density MultiMedia CD is similar to today's standard CD with a reflective coating on the moulded substrate.



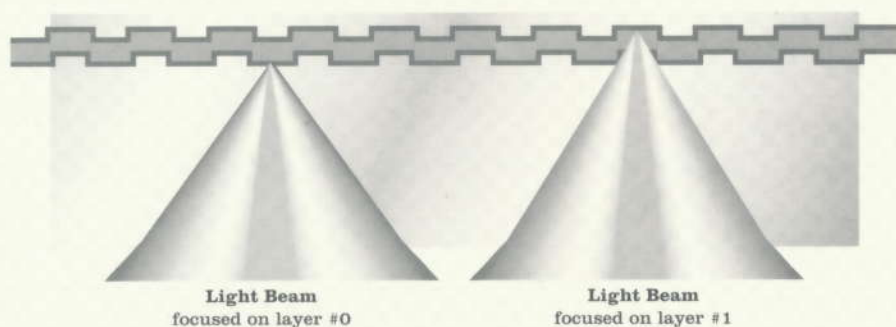
Schematic of current CD and single-layer MMCD, left, compared with dual-layer MMCD

The dual-layer disc starts with the same moulded substrate for the first data layer. Then a special semi-reflector, developed by 3M, is applied. This is followed by the application of the second information layer.

The remaining process steps are the same for both standard layer and dual-layer discs. The laser beam can focus on the first information layer, or transmit through it and focus on the lower information layer. The semi-reflective material provides just the right

proposed multi-layer, multi-disc, or multi-platter configurations in that it utilises conventional CD manufacturing equipment in conjunction with an additional process to produce a dual-layer high density format. For CD replicators, this provides the benefit of better capital utilisation and allows an easy migration from standard to high density and dual-layer replication.

The process allows single-layer, high-density discs to be produced with few modifications to existing



Cross-section of a dual-layer disc, showing laser to focus on upper or lower information layer.

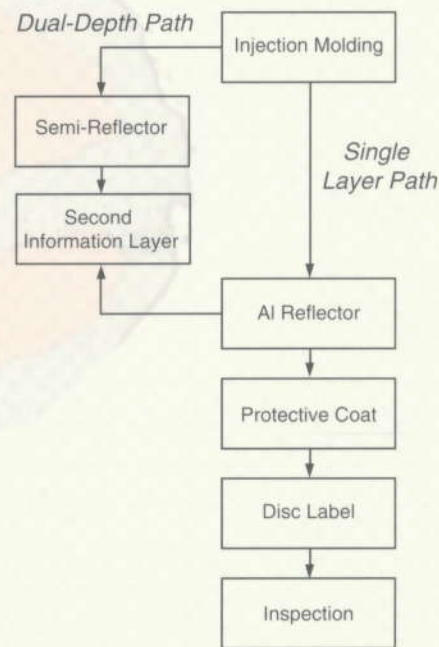
characteristics to reflect as well as transmit light to meet the reflective requirements of twenty to forty percent, called for by the proposed Sony/Philips specification for dual-layer discs.

MultiMedia CD Manufacturing

The configuration of the dual-layer is uniquely different from other

moulding equipment. The conversion to dual-layer production is relatively simple with additional production stations integrated into a standard CD manufacturing line. Conventional CD reflector coaters will be used to apply the semi-reflective layer to the dual-layer discs. The information layer provides the necessary separation of the two data layers to avoid

undesirable cross-talk. This information layer is coated with a full layer of aluminium, like current CDs. The process will utilise a photo-polymerisation technique to provide uniform thickness spacing and to replicate the second information layer. 3M has utilised this well-known type of UV curable photo-polymer since 1981 for replication of laser videodiscs. This process has been commercially successful, even for complex ISO-MO and LD formats, with yields exceeding ninety percent.



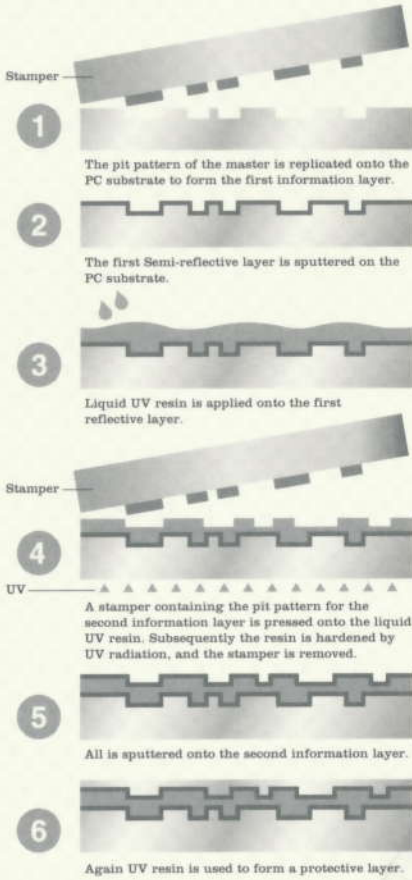
This is how simple a standard CD manufacturing line is transformed into a single or dual-layer MMCD line.

The photo-polymer coating may be cured through the moulded disc and the semi-reflective coating, using commercial ultra-violet systems. The manufacturing cost of CDs, MMCDs and SDs may vary depending on the specific manufacturing conditions and logistics. Comparison of manufacturing costs of several configurations with the standard density Compact Discs shows differences ranging from some twenty percent to over two hundred percent.





Production method of dual-layer discs



(Processes 1, 3, 5 are the same as used in CD manufacture)

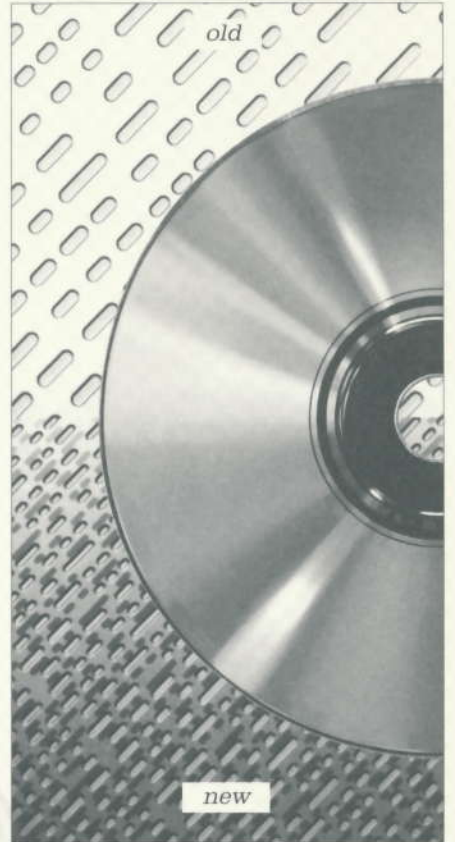
3M Dual-layer Advantages

Several alternatives have been proposed to increase a high density MultiMedia CD beyond the 3 - 4 Gigabyte range for a single-

sided disc. IBM has demonstrated a multi-platter disc which combines several thin substrates bonded together in a vertical stack with an air gap between each layer. The SD alliance propose a DVD specification which utilises two thinner moulded discs bonded back-to-back and capable of storing up to 10 Gigabytes. While both products have the potential of higher total storage capacity in multi-disc (platter) mode, there are several drawbacks to these proposals which are better served with 3M's dual-layer configuration. It is also rewarding to see that the SD alliance has started to present a dual layer concept as well.

Moulding and Yields

New moulds, process parameters and potentially, new moulders are needed specifically to produce the thin substrate SD discs. The dual-layer configuration, as developed by 3M, uses existing CD moulders to produce standard size substrates. This allows disc manufacturers to amortise their capital equipment over both standard and high density moulding requirements as the formats develop. Experts estimate that SD manufacturing will require an additional investment of 0.5 and 1 million US\$ per production line. In addition, bonding two different discs may introduce logistical complications on production lines with one

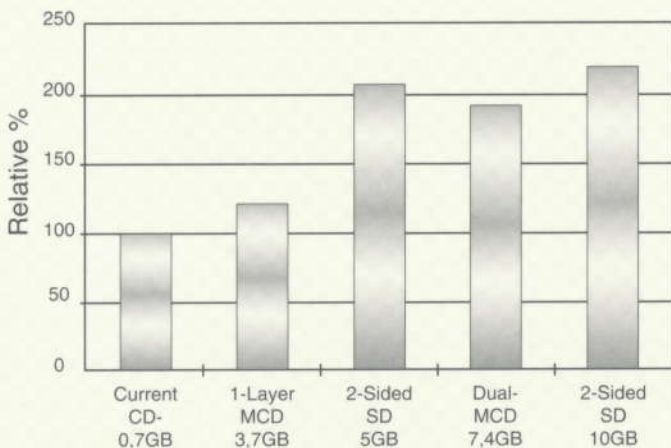


moulding machine. This may also cause lower yields on production lines with one or two moulding machines, when one side is poor. A bonding process may have high yields, but by definition percentages will be inferior to a single disc process.

Production Requirements

While the thin substrate discs can hold up to twenty percent more capacity in one of the proposed formats, two disc sides must always be used regardless of the programme length. The cost per side is constant for applications greater than 5 GB. For less than 5 GB applications, a second moulded blank side must still be manufactured and adhered to the back to produce a disc with a thickness of 1.2 mm. This production penalty adds to the overall cost of production as outlined before.

This article with courtesy of W.R. (Rusty) Rosenberger, Business Development Manager, 3M Company.



Relative manufacturing cost comparison CD, MMCD and SD (Source: 3M Corp.)

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First PC manufacturer endorsing new high density MMCD format Gateway 2000 joins MultiMedia CD Group

Philips Electronics and Sony Corporation announced recently that Gateway 2000, a leading provider of multimedia personal computers, has joined the group of companies endorsing the new MultiMedia CD format.

This makes that company the first PC manufacturer of the group. "We have carefully evaluated various high density disc formats that have been proposed," said CE Waitt, President and CEO of Gateway 2000. "The MMCD format offers the type of reliability, affordability and backward compatibility that is essential to meet today's expanding optical storage requirements. With MultiMedia CD, Philips and Sony have responded better to PC users' needs," adds Mr. Waitt. Gateway 2000 has been in the forefront of bringing multimedia to the PC enthusiast. The MMCD platform will allow Gateway 2000 to create new and exciting opportunities for multimedia in the future. Philips and Sony company spokesmen expressed their happiness with the arrival of Gateway 2000 and confirmed that the MMCD format proposal continues to gain support every day.

Growing PC Industry Support

Gateway 2000 joins a growing list of CD-ROM drive manufacturers who have announced their support for the new multimedia format.

Actually this list comprises such names as Acer Peripherals Inc., Alps Electric, Aztec Systems Ltd., Lion Optics Corporation, Mitsumi Electric Company, Ricoh Company, Teac Corporation, and Wearnes Peripherals. This group of manufacturers, including Philips and Sony, represents approximately seventy percent of the CD-ROM drive industry. They will produce some seventeen to eighteen million drives this year alone.

Entertainment Companies Supporting MultiMedia CD

It is well known that Sony and Philips have an important share in the movie industry. Sony Pictures Entertainment's production companies include Columbia Pictures, Tristar Pictures, Sony Pictures Classics and Triumph Films. PolyGram Filmed Entertainment includes Interscope, Propaganda, Island Pictures and Egg Pictures. Sony's and Philips' entertainment operations support the MultiMedia CD format unanimously and will make movies and related products available on MultiMedia CD discs. One single layer, high density MultiMedia CD disc provides users with up to

135 minutes of D1-like quality of MPEG 2 compressed full motion video, with an average playback transfer rate of 3 Mbps. The dual-layer configuration can store two full length feature films or up to 270 minutes of video within the same specification.

Consumer Electronics Companies Update

Aiwa, Bang and Olufsen, Grundig, Magnavox, Marantz and Nokia have already announced that they will manufacture and market consumer products based on the MultiMedia CD format. Along with Philips and Sony these companies manufacture and sell over fifty percent of the current CD player world market.

JVC agrees with Sony and Philips about the suitability of the Sony/Philips high-density MultiMedia CD proposal as a fully backward-compatible platform that will expand the Video-CD format base. JVC and Philips created the Karaoke CD format on the basis of MPEG 1 in March 1993. JVC then went on to develop the highly successful Video-CD format in Japan which in essence is an extension of the Karaoke CD.

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Why Nokia Supports MultiMedia CD

Nokia Consumer Electronics of Finland, a leader in mobile telecommunication products and consumer electronics products, has announced its decision to endorse the new MultiMedia CD as proposed by Sony and Philips. "Our decision to support the format was unanimous" said Dr. Helmut Stein, Vice President, Technology & New Businesses of Nokia Consumer Electronics.

"We believe it offers advantages in ease of use, manufacturability and affordability over other proposed disc formats. In addition its compatibility with existing CD-based discs ensures that our consumers will enjoy the greatest range of benefits that technological advances in digitisation offers. Nokia hopes to utilise MMCD to expand its consumer electronics operations and further its presence

NOKIA

in the evolving multimedia age" Dr. Stein adds. Both Sony and Philips expressed their happiness about Nokia's decision. This adds a major player in the European consumer electronics market to the group that has decided to support the MMCD format.

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