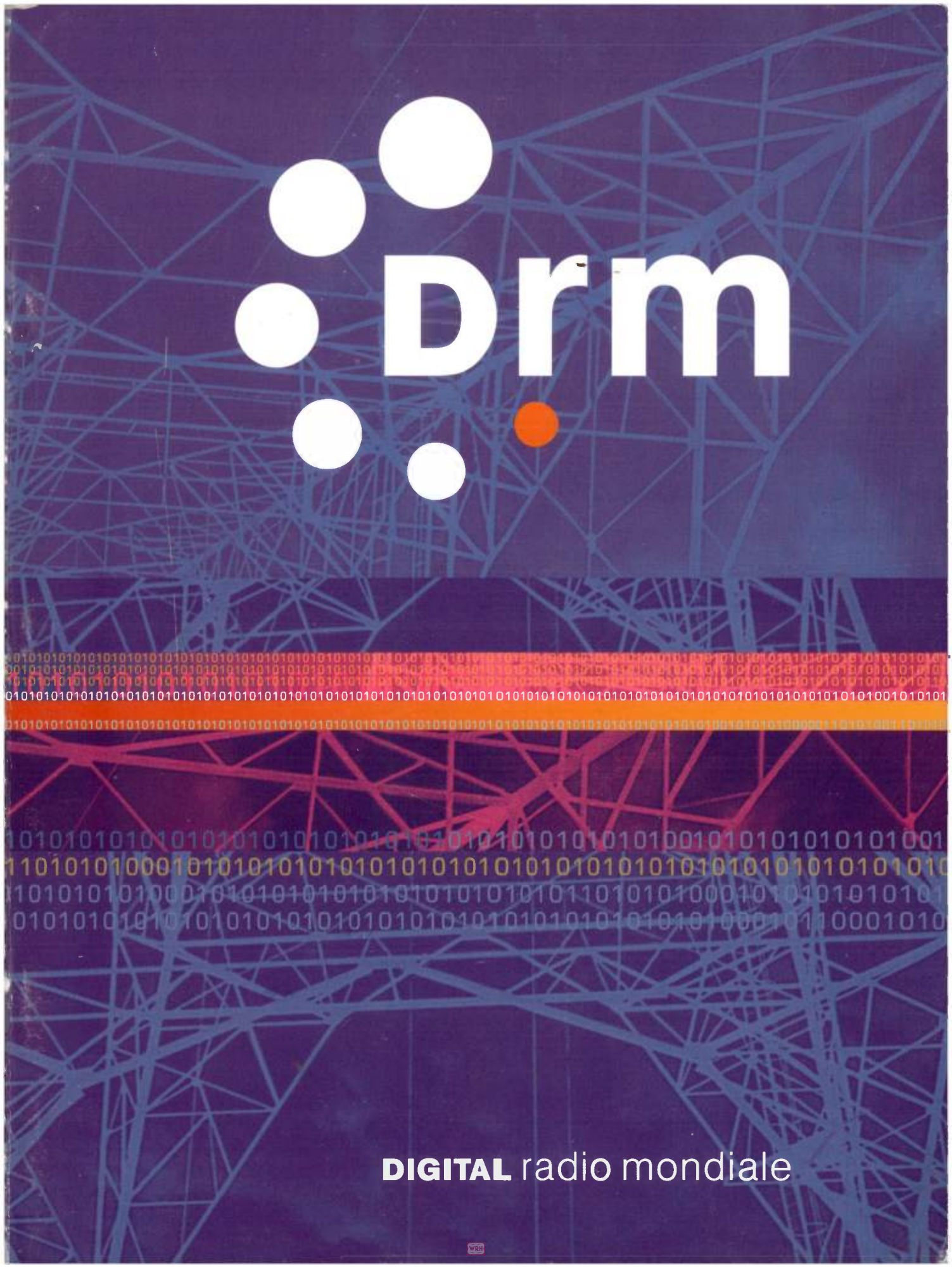
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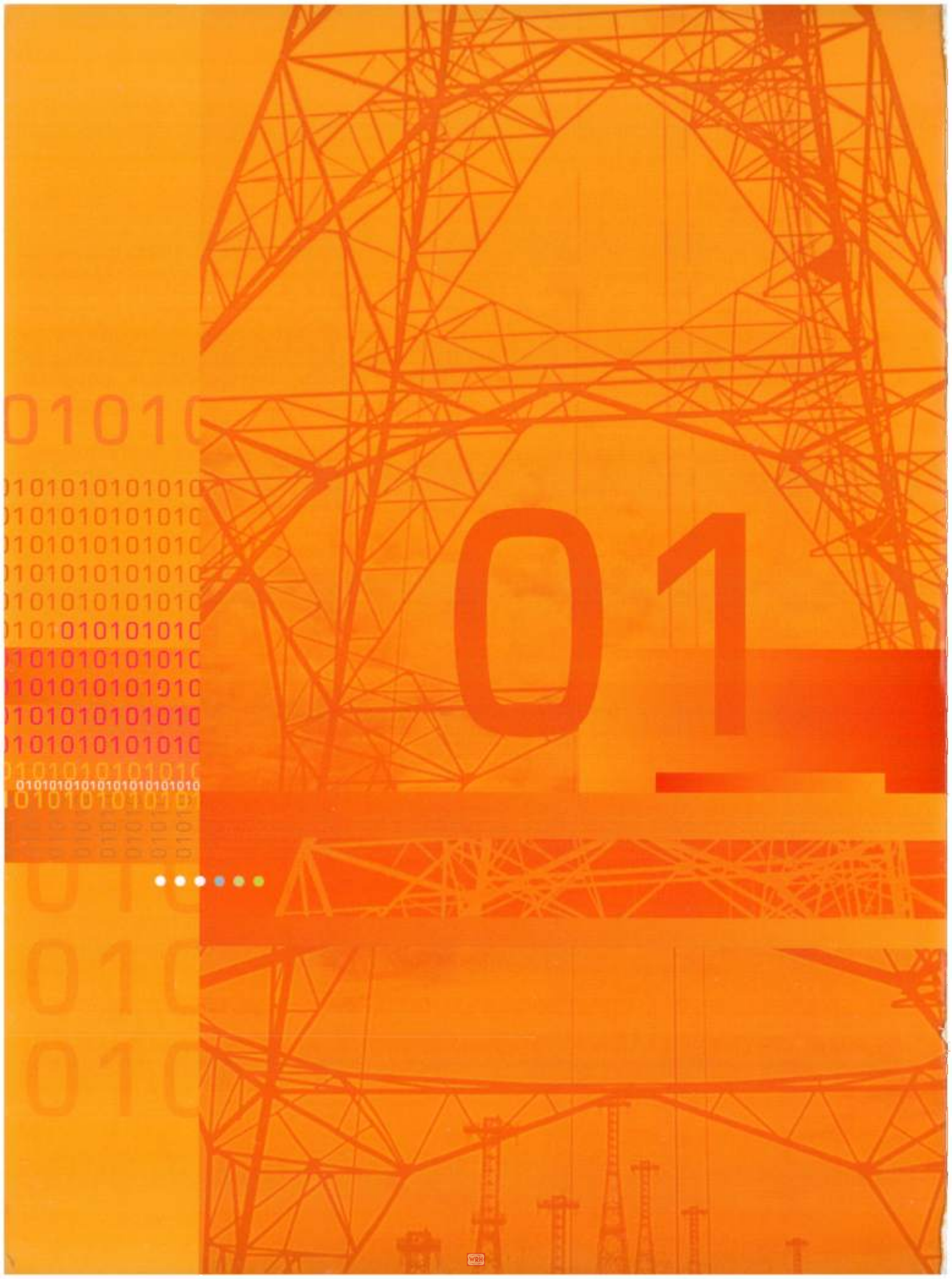
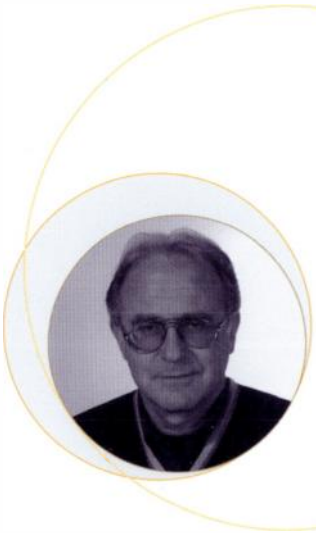

01

DRM: Revitalizing AM Radio in Markets Worldwide

A Message from Peter Senger, DRM Chairman



When our universal, on-air system called Digital Radio Mondiale™ (DRM™) launches in the near future, it will revitalize the AM broadcasting bands below 30 MHz in markets worldwide.

The clarity of DRM's near-FM quality sound offers a dramatic improvement over analogue AM. The static, interference and fading that have hampered short-wave, medium-wave and long-wave transmissions for decades will be history. And DRM will breathe new life into AM radio by integrating audio with data and text displayed on DRM receivers.

DRM is the world's only non-proprietary, digital AM system that has the ability to use existing frequencies and bandwidth across the globe. Simulcast modes are detailed in the DRM system specification, including those for combined signals within 9 or 10 kHz of spectrum.

The DRM system has the capacity to fit consumers' changing needs, with applications for home receivers, portable and car radios, software receivers and PDAs.

DRM is on a fast track toward universal standardization. The International Telecommunications Union (ITU) approved its recommendation of the DRM system in April 2001. In September 2001, the European Telecommunications Standards Institute (ETSI) published the technical standard for DRM's on-air system.

At the International Broadcasting Convention (IBC) in Amsterdam in 2001, we showcased new equipment built for the DRM system by our manufacturer members. DRM unveiled in-car, mobile reception tours at IFA, Germany's largest consumer electronics show, in Berlin in 2001.

The DRM Consortium was formed in 1998 when a small group of media organizations and manufacturers agreed to collaborate to create a universal, affordable digital AM radio system. In four years, DRM has expanded into an international consortium of 74 of the world's most respected broadcasters, manufacturers, network operators, researchers, broadcasting unions and regulatory bodies.

If your company would like to join us in revitalizing AM radio in markets worldwide, I encourage you to become a DRM member. As a member, you will have inside access to the upcoming launch of this exciting new technology.

Sincerely,

Peter Senger
DRM Chairman

The DRM Consortium

The DRM Consortium formed in 1998 when a small group of pioneering broadcasters and manufacturers joined forces to create a universal, digital system (also called DRM) for the AM broadcasting bands below 30 MHz – short-wave, medium-wave and long-wave. Since then, DRM has expanded into an international consortium of 74 broadcasters, manufacturers, network operators, research institutions, broadcasting unions and regulatory bodies.

DRM's membership is global in scope, with members representing 27 nations and several continents. DRM's membership is rich in its diversity, with members from countries as varied as Ecuador, Tunisia, Germany, China, the U.S.A., Nigeria, Finland, India, the U.K., Japan, Spain and Australia.

Even more impressive than the size and scope of DRM's membership is its quality. DRM is the place where engineers from cutting-edge global manufacturing firms work in tandem with the world's best-known media organizations.

DRM celebrated its fourth anniversary on March 5th, 2002. Its inaugural meeting took place in Guangzhou, China in 1998.

DRM is governed by an 18-member Steering Board.

The DRM System: Revitalizing AM Radio

The leading-edge experts of the DRM Consortium have created an on-air system (called DRM) that will rejuvenate AM radio markets worldwide.

- DRM offers clear, near-FM quality audio
- DRM has the capacity to integrate sound with data and text
- DRM uses existing AM frequencies and bandwidth
- DRM has simulcast modes
- DRM is universal, and adaptable to radio markets worldwide
- DRM is non-proprietary
- Many existing transmitters can be easily modified for DRM
- DRM receivers will tune themselves automatically

DRM's Members

- **Australia**
  FARB
- **Canada**
  Nautel Ltd.
  Radio Canada International
- **China**
  Academy of Broadcasting Science of China
- **Croatia**
  Riz Transmitters
- **Czech Republic**
  HFCC
- **Ecuador**
  ESPOL, HCJB World Radio
- **Egypt**
  Egyptian Radio and TV Union
- **Finland**
  Digita Oy, Kymenlaakso Polytechnic
- **France**
  Atmel ES 2, CCETT, Radio France, Radio France Internationale, TéléDiffusion de France, Thales Broadcast & Multimedia (formerly known as Thomcast SA)
- **Germany**
  APR, Coding Technologies GmbH, Deutsche Telekom AG, Deutsche Welle, DeutschlandRadio, DLM, Sender Europa 1, Fraunhofer IIS-A, Innovationszentrum Telekommunikationstechnik GmbH IZT, IRT, Medienanstalt Sachsen-Anhalt/Digitaler Rundfunk Sachsen-Anhalt, Micronas GmbH, Robert Bosch GmbH, Sony International Europe, SWR Südwestrundfunk, TELEFUNKEN SenderSysteme Berlin AG, University of Applied Sciences - FH Merseburg, University of Hannover, University of Ulm, VPRT
- **Hungary**
  Antenna Hungaria, Communications Authority Hungary
- **India**
  All India Radio
- **Italy**
  RAI
- **Japan**
  Hitachi Kokusai Electric Ltd., JVC Victor Company of Japan, Ltd., NHK
- **Luxembourg**
  Broadcasting Centre Europe
- **Malaysia**
  Asia Pacific Broadcasting Union
- **The Netherlands**
  Nozema, Radio Netherlands
- **New Zealand**
  Radio New Zealand International
- **Nigeria**
  Voice of Nigeria
- **Norway**
  Telenor/Norkring
- **Russia**
  Main Centre for Control of Broadcasting Networks/Voice of Russia
- **Spain**
  Retevision, Universidad del Pais Vasco
- **Sweden**
  Factum Electronics AB, Radio Sweden International, Teracom SE
- **Switzerland**
  EBU, International Committee of the Red Cross, ITU
- **Tunisia**
  Arab States Broadcasting Union
- **U.K.**
  BBC, Christian Vision, LSI Logic Europe, Merlin Communications International Ltd., QinetiQ, RadioScape Ltd., Roke Manor Research Ltd.
- **U.S.A.**
  Continental Electronics, a division of Metric Systems Inc., Harris Broadcast Corporation, IBB/VOA, National Association of Shortwave Broadcasters, Sangean America, Inc. and TCI, a Dielectric Company

About the AM Broadcasting Bands

Within the broadcasting bands below 30 MHz, audio is currently conveyed using amplitude modulation (AM). Hence the term, "the AM broadcasting bands," which include short-wave, medium-wave and long-wave. Note: This terminology differs in the U.S.A., where medium-wave is commonly referred to as "AM," and short-wave and long-wave are referred to separately.

There are more than 2 billion AM radio receivers in use across the globe today. AM radio is truly a universal technology – it exists throughout the world. AM radio receivers work to the same standard everywhere – if you buy a receiver in France, it can pick up signals in the same way anywhere in the world you take it. AM radio receivers are also inexpensive, which means that people in both developed and developing countries have access to the technology.

In many areas, especially in remote or developing regions, AM is the sole radio option, with no FM service available. Why? Because FM signals cannot travel as far as some AM signals can, transmitters must be situated closer to the listeners. Transmitters are not always available in sparsely populated areas. So, many people in remote areas rely on international broadcasts from other countries for vital information such as news.

Still, while AM receivers are widely available and easy to use, the sound quality is inferior to that of FM radio. Since its inception, AM radio's major drawback has been poor sound quality characterized by static, interference and fading. Consumers' tolerance for AM noise has decreased in recent years, as digital quality sound in general has emerged. This is especially true in areas with an abundance of higher-quality audio options, such as CDs, FM radio and Internet radio.

Another drawback to some AM transmissions, such as short-wave, is the fact that listeners have to search for their favorite programs. Because environmental factors such as changes in the ionosphere and sunspots affect the way in which short-wave transmissions travel, broadcasters must regularly shuffle the frequencies on which their programs air. That means that short-wave listeners spend a considerable amount of time searching for their favorite programs.

About Short-wave, Medium-wave and Long-wave

Long-Wave: The Low-frequency (LF) broadcasting band is also called long-wave. It works well for national radio coverage and beyond. It is popular in Europe.

Medium-Wave: Medium-frequency (MF) or medium-wave is used widely across the globe.

Short-Wave: High-frequency (HF) or short-wave excels at international broadcasting across large distances. In some cases, it is used for national coverage of large countries, or in tropical conditions.

DRM: The Clear Choice for Consumers Worldwide

The dramatic improvements offered by the DRM system will revitalize AM radio in markets worldwide. DRM will provide AM listeners with exceptional clarity and real convenience.

DRM Offers Clear, Near-FM Quality Sound

The clarity of DRM's near-FM quality sound will replace the static, interference and fading that have handicapped analogue short-wave, medium-wave and long-wave transmissions. DRM offers consumers a dramatic, immediately noticeable improvement in audio quality.

DRM Offers Audio Plus Text, Data

Besides providing near-FM quality audio, DRM can integrate data and text. This means that consumers listening to music programming could see supplemental information, such as the artist's name or the song title, displayed simultaneously on their DRM receiver. Or, they could receive additional data unrelated to the audio programming, such as weather forecasts or news tickers.

DRM Will Be Available on the Same Frequencies as Analogue AM

DRM works on existing AM frequencies, making the transition from analogue to DRM seamless for radio listeners.

DRM Has Simulcast Capability

A number of simulcast modes (in which broadcasters can send an analogue and DRM signal simultaneously) are detailed in the DRM system specification, including those for combined signals within 9 or 10 kHz of spectrum. This will contribute to a seamless transition for listeners.

DRM Extends to Numerous Applications

DRM will be available for home receivers, portable radios, car receivers, software receivers and PDAs.

DRM Receivers Tune Themselves

The DRM system takes the hassle out of finding certain types of AM transmissions such as short-wave. Instead of fiddling with a receiver's tuner knob to pull in a distant signal, consumers can simply plug in the name of their favorite station or program. The DRM-equipped receiver will tune itself, using a technology called "frequency optimisation."

DRM Will Be Available Worldwide

Since the DRM standard will be universal, DRM receivers will work the same way in markets worldwide.

DRM: Technical Aspects of the On-Air System

The DRM on-air system will propel the AM broadcasting bands below 30 MHz – short-wave, medium-wave and long-wave - to the next level.

DRM is the only universal, non-proprietary digital AM radio system with near-FM quality sound available to markets worldwide.

The quality of DRM audio is excellent, and the improvement upon analogue AM is immediately noticeable. DRM can be used for a range of audio content, including multi-lingual speech and music.

Besides providing near-FM quality audio, the DRM system has the capacity to integrate data and text. This additional content can be displayed on DRM receivers to enhance the listening experience.

Unlike digital systems that require a new frequency allocation, DRM uses existing AM broadcast frequency bands. The DRM signal is designed to fit in with the existing AM broadcast band plan, based on signals of 9 kHz or 10kHz bandwidth. It has modes requiring as little as 4.5kHz or 5kHz bandwidth, plus modes that can take advantage of wider bandwidths, such as 18 or 20kHz.

A number of simulcast modes are detailed in the DRM system specification, including those for combined signals within 9 or 10 kHz of spectrum. Tests are underway to determine the best relative levels at which the analogue and digital signals should be transmitted in the simulcast modes.

Many existing AM transmitters can be easily modified to carry DRM signals.

DRM applications will include fixed and portable radios, car receivers, software receivers and PDAs. Several early prototype DRM receivers have been produced, including a software receiver.

The DRM system uses a type of transmission called COFDM (Coded Orthogonal Frequency Division Multiplex). This means that all the data, produced from the digitally encoded audio and associated data signals, is shared out for transmission across a large number of closely spaced carriers. All of these carriers are contained within the allotted transmission channel. The DRM system is designed so that the number of carriers can be varied, depending on factors such as the allotted channel bandwidth and degree of robustness required.

The DRM system can use three different types of audio coding, depending on broadcasters' preferences. MPEG4 AAC audio coding, augmented by SBR bandwith extension, is used as a general-purpose audio coder and provides the highest quality. MPEG4 CELP speech coding is used for high quality speech coding where there is no musical content. HVXC speech coding can be used to provide a very low bit-rate speech coder.

The robustness of the DRM signal can be chosen to match different propagation conditions.

The DRM Multiplex

The DRM multiplex consists of three channels:

1. Main service channel (MSC)

Contains the data for all the services in the DRM multiplex. The gross bit-rate of the MSC is dependent on the DRM channel bandwidth and the transmission mode.

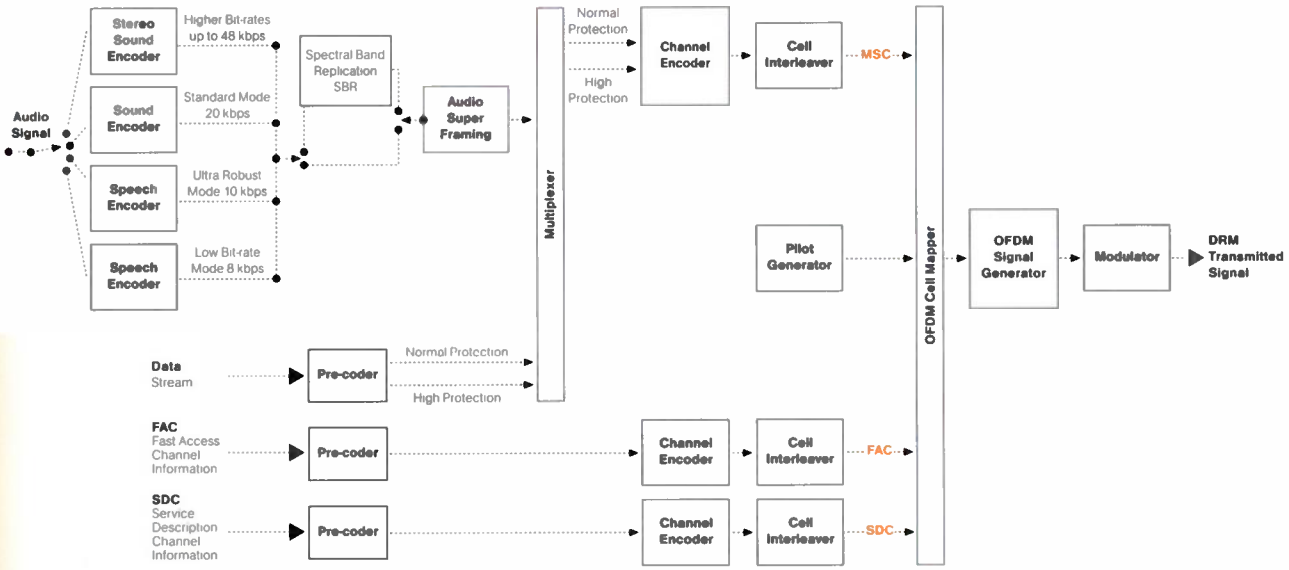
2. Fast access channel (FAC)

This provides service selection information and contains information about the channel parameters (for example, the spectrum occupancy and interleaving depth) so that a receiver is able to decode the multiplex and information about the services in the multiplex.

3. Service description channel (SDC)

The SDC contains information about the attributes of the services within the multiplex such as alternative frequencies, frequency schedules and audio metadata information.

The DRM System Overview



The Road to AM Revitalization

Universal Standardization

The DRM system will be standardized to work in the same way in any country. It will utilize existing AM frequencies and bandwidth. It will be available in radio markets worldwide. DRM is well on its way toward its goal of universal standardization.

The International Telecommunications Union (ITU) approved its recommendation of the DRM system in April 2001. After successful field tests, DRM had submitted its system to the ITU's Radiocommunications sector (ITU-R) in 2000. The ITU-R subsequently recommended the system for approval by its 189 member countries.

In September 2001, the European Telecommunications Standards Institute (ETSI) published the technical standard for DRM's on-air system. The document is called ETSI TS 101 980 V1.1.1 (2001-09), Digital Radio Mondiale (DRM); System Specification. Free downloadable copies are available at the ETSI Web site at http://www.etsi.org (use the search parameter DRM).

DRM will showcase its digital on-air system to administrations attending the ITU's World Radio Congress in Caracas, Venezuela in June/July, 2003.

DRM Prototype Equipment

DRM's manufacturer members have begun introducing prototype equipment specially built for the DRM system.

Several models debuted at the International Broadcasting Convention (IBC 2001) in Amsterdam. Live, short-wave transmissions from as far away as 5,000 kilometres reached the DRM booth on receivers provided by DRM members Fraunhofer IIS-A and the BBC. DRM member Thales Broadcast & Multimedia exhibited a complete, end-to-end DRM chain including a digital exciter and a digital reference receiver, illustrating the high flexibility of the DRM system. The live transmissions were provided by DRM members Radio Canada International, Deutsche Welle and Deutsche Telekom AG. Also making its debut at IBC 2001 was a DRM audio encoder provided by DRM member Coding Technologies GmbH.

The software receiver provided by Fraunhofer IIS-A uses a standard PC platform together with an external, commercial HF receiver provided by AOR. It has options for audio, multimedia services, monitoring and recording, signal analysis and remote control.

The BBC-developed receiver is a stand-alone platform for reception and monitoring applications within DRM. Based on a 166 MHz Digital Signal Processor with 32 Mbyte DRAM and 4 Mbyte Flash, the receiver can be controlled remotely via RS232. The receiver architecture supports a wide range of monitoring functions through an integral 8x40 character display. It is capable of demodulating multiple DRM channels simultaneously.

The Thales Skywave 2000 product line was designed to create, transmit, receive and analyse DRM digital signals. Its digital exciter allows broadcasting of a digital signal fed into an existing transmitter, either with linear amplification or most modern PSM, PDM or full solid-state transmitter types. The digital reference receiver performs end-to-end, real time signal demodulation and decoding, according to the type of the received signal.

The DRM audio encoder provided by Coding Technologies GmbH was built together with MAYAH Communications. It encodes AAC+SBR in real time and offers professional audio and network hardware interfaces.

At IFA 2001 in Berlin, Fraunhofer IIS-A showcased a content server. The Fraunhofer DRM ContentServer provided AAC+SBR realtime audio encoding (licensed from Coding Technologies GmbH), as well as processing for DRM data services, and DRM multiplex generation. DRM member Sachsen-Anhalt/Digitaler Rundfunk Sachsen-Anhalt uses the content server for pilot broadcasts including audio and multimedia.

Also, DRM members CCETT and Roke Manor Research Ltd. have developed DRM prototype receivers in their laboratories.

The Road to AM Revitalization

Mobile Reception

DRM can be used for mobile listening in automobiles. For the first time ever, radio listeners got the chance to hear DRM live via mobile reception in August 2001.

More than a hundred people sampled DRM's newly developed, near-FM sound during listening tours in a presentation car at IFA 2001 in Berlin, Germany's largest consumer electronics show. Tour participants heard six radio stations broadcasting live via DRM, five on medium-wave/AM (including single frequency network) and one on short-wave. Tour equipment came from DRM members and supporters – Deutsche Telekom AG provided the network and vehicle, and coordinated transmissions. TELEFUNKEN SenderSysteme Berlin AG provided transmitters, Fraunhofer IIS-A supplied a content server and receivers, and Radiostroy RTV contributed antennas.

DRM Chairman Peter Senger unveiled the mobile reception tours in a bilingual (German/English) press conference in IFA's Science & Technology Forum.

Global Visibility

Increasingly, DRM has become a focal point at broadcast industry expositions across the globe, as crowds gather to hear DRM's live transmissions and examine DRM prototype equipment on display.

DRM's experts appear on broadcasting and technology industry panels worldwide. Their seminars and speeches are offered in a multitude of languages befitting DRM's international scope.

You might have seen DRM at the NAB Convention in Las Vegas, the International Broadcasting Convention (IBC) in Amsterdam, and IFA 2001 in Berlin, Germany's largest consumer electronics show. DRM has been showcased at BES India, Broadcast Asia, the Commonwealth Broadcasters Association General Conference, CEPT 2000, and many more.

As DRM's global profile continues to grow, its coverage in industry and business press expands. Key industry trade publications as well as newspapers, Web sites, radio programs and wire services in many countries are keeping pace with DRM's developments.

For the latest DRM updates, plus schedules of upcoming DRM speakers and exhibits, visit the DRM Web site at www.drm.org.

DRM Offers Clear Advantages for Broadcasters

DRM will rejuvenate AM radio markets worldwide, offering broadcasters new opportunities to increase listener loyalty and reach new audiences. DRM offers broadcasters a range of dramatic improvements over analogue, and conversion is easy and cost-effective.

Existing Frequency Allocations Can Be Used

Unlike digital systems that require new frequency allocation, DRM operates at existing AM broadcasting frequencies. The DRM signal is designed to fit in with the existing AM broadcast band plan, based on signals of 9 kHz or 10kHz bandwidth. It has modes requiring as little as 4.5kHz or 5kHz bandwidth, plus modes that can take advantage of wider bandwidths, such as 18 or 20kHz.

Simulcast Capability

A number of simulcast modes (in which broadcasters can send an analogue and DRM signal simultaneously) are detailed in the DRM system specification, including those for combined signals within 9 or 10 kHz of spectrum. Tests are underway to determine the best relative levels at which the analogue and digital signals should be transmitted in the simulcast modes.

Clear, Near-FM Audio Quality

DRM's near-FM quality sound offers a dramatic improvement over the crackle and pop of analogue AM.

You Can Enhance Your Programming With Text, Data

Besides providing your listeners with near-FM quality audio, the DRM system gives you the option to integrate data and text. This additional content can be displayed on DRM receivers to enhance the listening experience.

Transmitters Can Be Easily Adapted for DRM

Transmitter manufacturers have been part of the DRM consortium from the beginning, and are already building DRM capabilities into new analogue transmitters. Many existing AM transmitters can be easily modified to carry DRM signals, while retaining their analogue capabilities.

DRM Can Reach Your Listeners Worldwide

DRM will be a universal standard, available in radio markets across the globe.

DRM Fits Your Listeners' Needs

DRM applications will include fixed and portable receivers, car radios, software receivers and PDAs. An early prototype DRM software receiver uses a standard PC platform together with an external, commercial high-frequency (HF) receiver. It has options for audio, multimedia services, monitoring and recording, signal analysis and remote control.

DRM: The Clear Advantages of Membership

Are you a manufacturer who is interested in building DRM equipment? Or a broadcaster who wants to expand your reach, and your audience, with the long-range, clear coverage of DRM? Perhaps you're a content provider who wants to offer text and data services to new DRM consumers?

If DRM's revitalization of the AM broadcasting bands appeals to your company, consider joining the leading-edge experts of the DRM Consortium. As a member, you'll enjoy access to DRM's upcoming launch in markets worldwide.

DRM offers a range of membership options tailored to your company or institution, and your budget.

For detailed information about joining DRM, please contact the DRM Project Office at projectoffice@drm.org or +49 221 389 1111.

DRM Online

Click onto DRM Online for the latest updates, technical information, DRM audio clips, and a schedule of upcoming DRM speaker and exhibit appearances worldwide. The DRM Website is at www.drm.org

DRM Contact Information

For more information about DRM, please contact the DRM Project Office.

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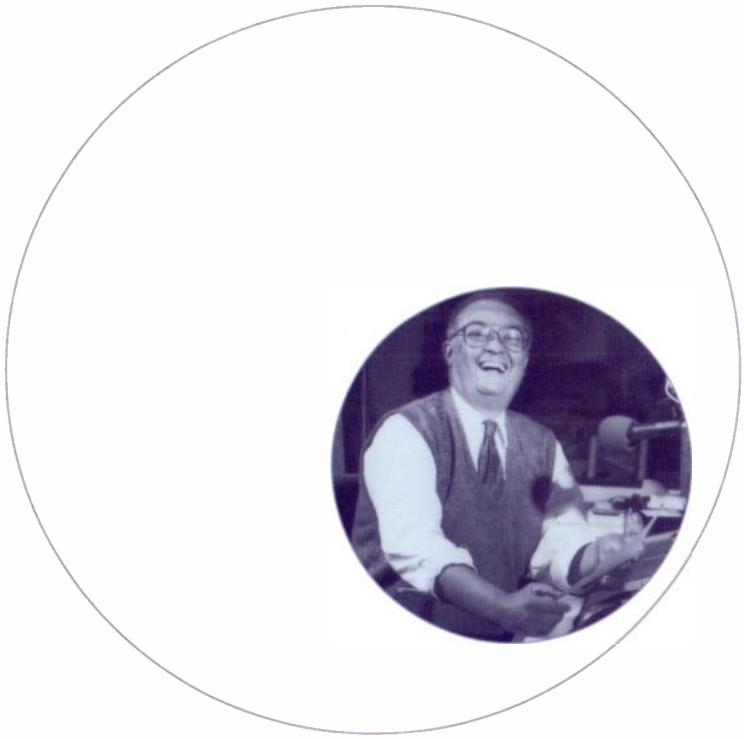

DRM Timeline

March 5, 1998

DRM Consortium Launched in Guangzhou, China

1999

System Evaluation

2000

Field Test Phases 1&2

DRM Standard Submitted to ITU-R

2001

January: DRM System Description Ready

April: ITU-Ris Recommendation of DRM System Approved

August: Mobile Reception Unveiled

September: ETSI Publishes Technical Standard

2002

System Verification Field Testing

Pilot DRM Broadcasts

2003

DRM To Launch At World Radio Congress in Caracas, Venezuela

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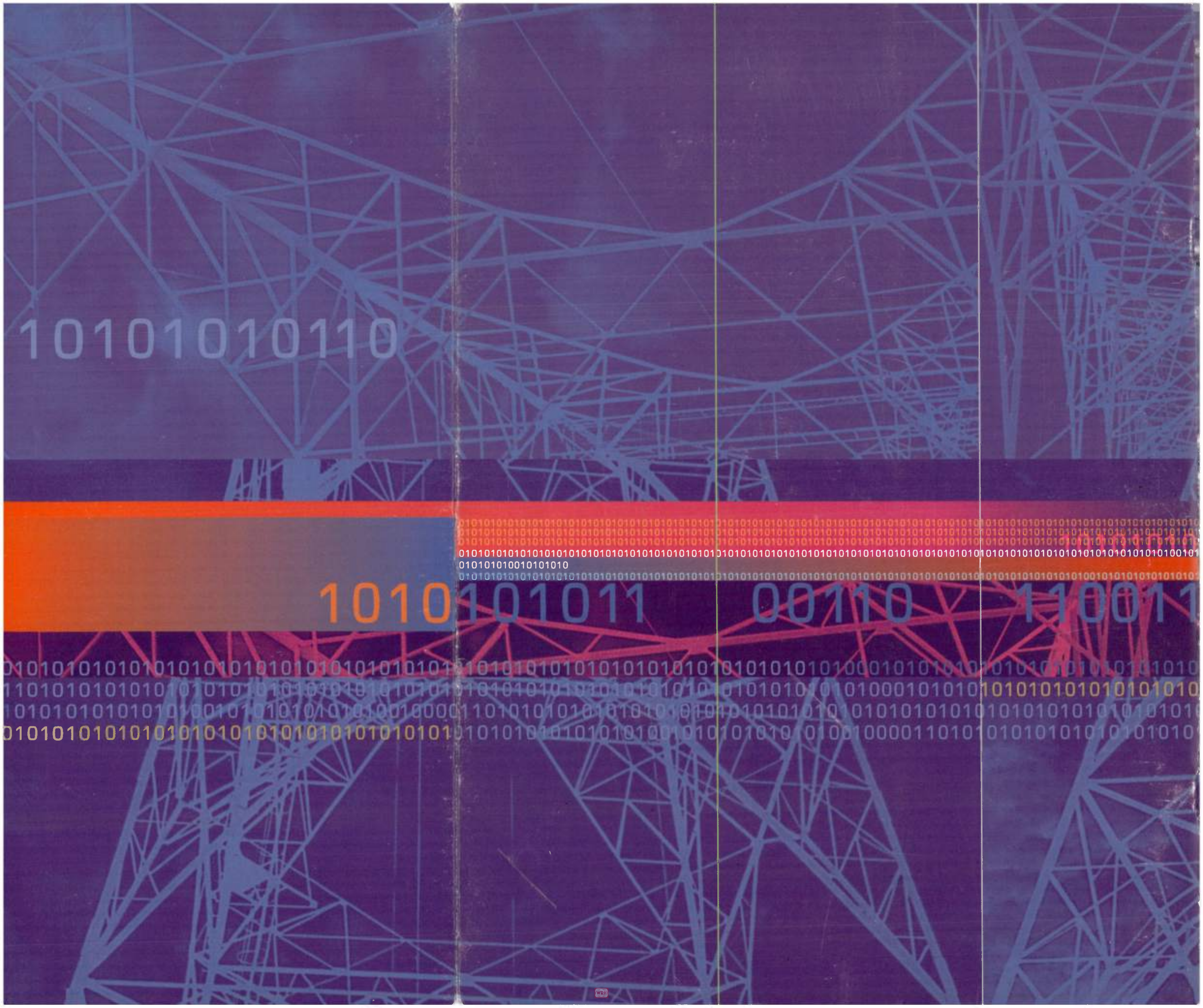
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