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DIGITAL RADIO MONDIALE

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ABSTRACT

The DRM system was designed as an eventual replacement for current analogue AM broadcasting. However the system was also specifically designed to allow these new digital transmissions to co-exist with current AM broadcasts. By this means the change over from analogue to digital broadcasting can be phased in over a period of years. This will ensure that expensively acquired and perfectly satisfactory transmission equipment. The DRM system has been designed to allow suitable analogue transmitters to be modified to switch easily between digital and analogue broadcasts. This can significantly reduce the initial investment cost for a broadcaster wishing to progressively migrate to DRM services and, by reducing the entry costs, allows broadcasters to introduce DRM services at an early stage.

I. INTRODUCTION

The DRM system was designed as an eventual replacement for current analogue AM broadcasting. However the system was also specifically designed to allow these new digital transmissions to co-exist with current AM broadcasts. By this means the changeover from analogue to digital broadcasting can be phased in over a period of years. This allows broadcasters to make the required investment on a timescale which meets their budgetary needs. This will ensure that expensively acquired and perfectly satisfactory transmission equipment is not suddenly made obsolete. Furthermore, unlike some other digital systems, the DRM system has been designed to allow suitable analogue transmitters to be modified to switch easily between digital and analogue broadcasts. This can significantly reduce the initial investment cost for a broadcaster wishing to progressively migrate to DRM services and, by reducing the entry costs, allows broadcasters to introduce DRM services at an early stage.

II. AM BROADCASTING

This topic contains a collection of short statements on items of interest to a broadcaster who may be considering the use of the DRM system. Many of these items are covered in more detail in subsequent topics. In this chapter they are categorized into 4 areas:

2.1 Background to AM broadcasting :

AM broadcasting developed in the early part of the twentieth century and the number of broadcasters and listeners grew rapidly so that today there are at least two billion radios capable of receiving broadcasts in one or more of these bands. With the development of the transistor and then the integrated circuit the real cost of these radios has dropped massively since the early days. At the same time portability has increased with reductions in size and weight whilst significantly lower power consumption has reduced the operating cost, since batteries need replacing less frequently. The rapid growth of broadcasting in these bands meant that most regions of the

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world today have access to at least basic radio services. In many cases these services are received not only from within the listener's country but from countries outside, providing access to a broad range.

Whilst many broadcasters will find it possible to modify their transmission equipment to provide digital, as well as analogue services, this will take time to complete and some transmission equipment, which is unsuitable for modification, will have to be entirely replaced. Ideally this replacement would be part of the normal equipment replacement life cycle. Over this migration period both analogue and digital broadcasts will co-exist .This means that new AM radios will need to provide both analogue and digital reception well into the future . Thus the digital reception facility will be in addition to, rather than instead of, analogue reception.

III. DRM SYSTEM

The Digital Radio Mondiale(DRM) system provides a universal, non-proprietary, digital transmission system – designed to replace, eventually, the current analogue transmissions in the LW, MW and SW bands. This article provides information on the DRM receivers that were demonstrated at IBC2002 during September. It also outlines the work being carried out with in a number of projects which aim to enable the early introduction of DRM consumer receivers.

The principle of DRM is that bandwidth is the limited element, and computer

Processing power is cheap. So modern CPU-intensive audio compression techniques enable more efficient use of available bandwidth.

This section goes into more detail on the way in which the DRM component parts form a DRM signal and covers such topics as the modulation, multiplex formation, signaling and audio coding. In essence the DRM system employs Coded Orthogonal Frequency Division Multiplexing (COFDM) using a large number of evenly spaced sub-carriers which are modulated using 4, 16 or 64 Quadrature Amplitude Modulation (QAM) depending on the application. A guard interval is added to transmitted symbols in order to ensure a high degree of resistance to multi-path caused by sky-wave propagation. The encoded audio or data signals are carried in a multiplex, which is impressed on these carriers. Three different audio coding systems are available to cover different broadcast requirements and conditions.

3.1 System Development :

In the development of the system it was necessary to objectively measure the performance of the system against the various requirements set out at the beginning of this programme. These measurements involved laboratory and field-testing not only to assure system performance but also to ensure that the specification, when introduced into standards organizations such as ETSI, IEC and ITU, was unambiguous and could be correctly interpreted by manufacturers not involved in the system's development.

3.2 Overall design :

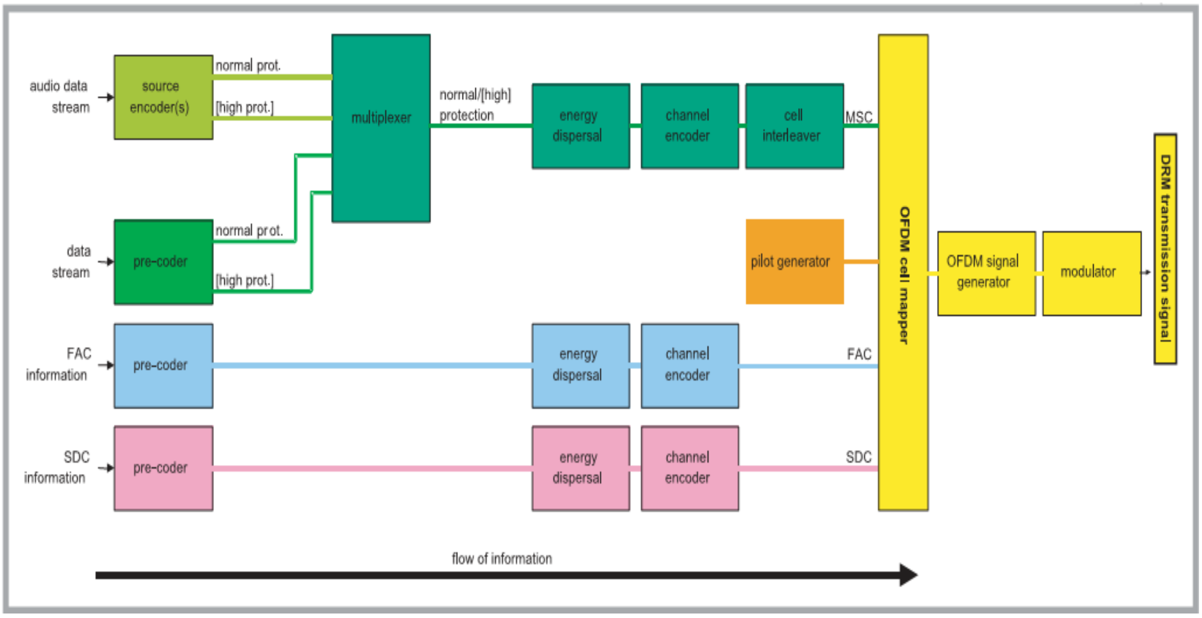

Fig: 3.1 Conceptual DRM transmission block diagram

Fig: 3.2 DRM receiver

A project, operating under the name of DIAM, is currently underway to design and fabricate a custom DRM chip set. This will see first silicon available for testing before the middle of 2004 and should enable the rapid development of early consumer receivers. This chip set will provide for the reception of existing analogue FM and AM services, in addition to DRM services, but will not extend to other digital radio services. Other organizations are already in process of designing applications, which will implement a DRM receiver on a multipurpose consumer processor. These DRM receivers are also likely to provide for analogue FM and AM reception, but in addition will provide for the reception of other digital radio systems such as DAB, IBOC or DARS.

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Inevitably the cost of first generation DRM enabled consumer radios will not be at the same price level that can ultimately be achieved by the time of, say, a third generation chip set. No consumer technology, introduced to date, has been able to enter the market at the price level that has been achieved after further generations have been developed. There is no reason why DRM receivers should be any exception to this rule. However it is noticeable that the development cycle of new consumer products is accelerating, so that prices fall faster than in earlier decades. The recent example of DVD players shows that prices can fall very rapidly when high volumes are produced in a large competitive market. If these same manufacturers turn their attention to the production of DRM radios this could have clear benefits for the speed with which prices fall. However, at the same time, it must be recognized that DRM is, to a large degree, a replacement technology for existing analogue radios, rather than a totally new technology, as is the case with mobile phones. Clearly new and exciting content will be as important a market-driver as the very significant quality increase over current analogue AM.

If programme content is an important driver of a new consumer technology like DRM, so should be the additional ease with which listeners should be able to operate the new radios. DRM provides significant improvements over current analogue AM technology in allowing the transmission of data to the radio. This enables the radio to find the best frequency on which to receive a programme, allows the display of additional information about the current or future programmes and enables text or audio based on-demand news and information services to be provided. These enhancements to the traditional audio-only radio service will require the receiver manufacturers to develop software to provide the functionality, an internal means of storing the data and a simple means of navigating to and playing back or displaying this stored material. This additional functionality will provide receiver manufacturers with a means of differentiating their products, but should also provide an additional incentive for listeners to invest in the new technology. Listeners will not just be buying a radio with better quality audio, but also receiving an enhanced and more listener friendly service. Tuning to a station could be by choosing a name from a menu of stations and, particularly for SW listening, the receiver should always find the best frequency for the region and time of day.

VI.CONCLUSION

The Digital Radio Mondiale (DRM) purpose is to develop a non-proprietary technical standard for the replacement of analog AM (Amplitude Modulation) radio with the digital radio, also called DRM.

The Digital Radio Mondiale system may be split into 4 parts: coding and modulation; multiplex formation; signaling and audio coding. In essence the DRM system employs Coded Orthogonal Frequency Multiplexing (COFDM) using a large number of evenly spaced sub-carriers which are modulated using 4, 16, or 16 Quadrature Amplitude Modulation (QAM) depending on the application. A guard interval is added to transmitted symbols in order to ensure a high degree of resistance to multi-path caused by sky-wave propagation. The encoded audio or data signals are carried in a multiplex, which is impressed on these carriers. Three different audio coding systems are available to cover different broadcast requirements and conditions.

Digital Radio Mondiale is a system that promises to re-invigorate the use of the broadcasting bands below 30 MHz. It offers a dramatic improvement in audio quality, not only improving the audio bandwidth and signal-to-noise ratio, but also countering the effects of selective fading and audible interference from other stations. It is also designed to support various features that will make receiver operation more user-friendly. Such features as

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identifying the station, listening alternative frequencies and supporting the provision of time-varying frequency schedules will transform the nature of listening, especially to broadcasts using short-wave bands.

All this is made possible by adoption of state-of-the-art digital techniques, from audio source coding to channel coding and modulation.

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