DRM+
The Efficient Solution for Digitising FM

ABU Digital Broadcasting Symposium 2009

A. Waal
Kuala Lumpur 10.03.2009
Contents

- What is DRM+?
- DRM+ system overview
  - Bandwidth
  - Data rate
  - Service information and data applications
- DRM+ for local and regional broadcasters
- DRM+ system components
- DRM+ and FM
- DRM+ transmitter diversity
- Conclusion
What is DRM+?

- DRM+ is part of the DRM system family
- DRM (mode A-D) is designed for LW, MW and SW digital broadcast
- DRM (mode E) – called DRM+ – is designed for digital broadcast in all broadcast bands up to band III (including band I and band II)
- DRM+ is an extension to DRM and not a replacement
Introduction

- DRM+ has a strong basis

- DRM+ will be an open worldwide standard

- DRM+ is supported by the strong DRM consortium
  - Broadcasters, network providers, regulatory bodies, research institutes and manufacturers
  - Over 100 Members from 34 countries

- DRM+ draft system specification available
  - Field tests are ongoing
  - Standardisation planned in 2Q 2009 at ITU/ETSI
DRM+ system overview

- Robust OFDM transmission system
  - Mobile reception also in multipath environments
  - Supports vehicle speed up to 300 km/h
  - Suitable for SFN networks

- Narrow bandwidth of only 96 kHz
  - Frequencies from 30 MHz to 174 MHz
  - Transmission also in small spectral gaps
DRM+ system overview

- OFDM parameter of DRM+ signal

<table>
<thead>
<tr>
<th>Modulation</th>
<th>OFDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data rates</td>
<td>40 - 186 kbps</td>
</tr>
<tr>
<td>Narrow bandwidth</td>
<td>~96 kHz</td>
</tr>
<tr>
<td>Subcarrier space</td>
<td>444,444 Hz</td>
</tr>
<tr>
<td>Number of subcarriers</td>
<td>213</td>
</tr>
<tr>
<td>Subcarrier modulation</td>
<td>4/16 QAM</td>
</tr>
<tr>
<td>Chanel coding</td>
<td>MLC</td>
</tr>
</tbody>
</table>
DRM+ system overview

- Same multiplex structure and signaling as DRM
  - Easy and fast extension to DRM receiver and transmitter developers
DRM+ The Efficient Solution for Digitising FM

DRM+ system overview

- Huge range of data rates from 37-186 kbit/s
  - Flexibility in number of services and content
  - Different modulations and code rates
  - Perfect trade-off between data rate and transmission power
  - Easy adaptation to broadcasters content
  - Easy adaptation to coverage area and transmission power

![Diagram showing data rates and SNR values for 4-QAM and 16-QAM modulations.](chart.png)
DRM+ system overview

- Flexible multiplex
  - 1 to 4 services within one multiplex

**Example 1:** Audio 1: 64 kbit/s, Data 1: 29 kbit/s, Audio 2: 64 kbit/s, Data 2: 29 kbit/s
Robust signal, large coverage area

\[ = 186 \text{ kbit/s} \]

**Example 2:** Audio 64 kbit/s, Data 12 kbit/s
Very robust signal, huge coverage area

\[ = 76 \text{ kbit/s} \]
- Audio coding with MPEG-4 HE-AAC v.2
  - Crystal clear sound quality
  - Efficient coding for stereo-compatible multichannel audio (5.1)
- Multichannel audio with MPEG Surround
  - Mono/stereo receivers are fully compatible with MPEG surround signal
  - Only slight increased bit rate (5 kbit/s) in comparison to stereo signal
DRM+ data services

- DRM+ supports different kinds of service information
  - Service label (UTF-8: all international character sets)
  - Time (UTC + local time offset)
  - Text message application
  - Announcements for traffic, news and warnings
    - TMC, TPEG
    - Including automatic receiver switching
  - Broadcast website
  - Slide show
  - News Service Journaline
  - Electronic Program Guide (EPG)
DRM+ is the only digital broadcasting system suitable for both, regional and local broadcasters

- Small coverage area with one frequency and one program
- Efficient spectrum utilization
- Without complex multiplexing: 4 programs are possible but not mandatory
DRM+ for broadcasters

- DRM+ supports heterogeneous station network
  - Service following (FM, DAB+, DRM)
  - Alternative frequency switching
  - Up to 4 programs with audio and data
Comparison DRM+ and FM

- **FM**
  - 3 frequencies
  - 1 program
  - Complex frequency planning

- **DRM+**
  - 1 frequency
  - Up to 4 program
  - Efficient spectrum use
  - Easy frequency planning (SFN)
Open standards for all interfaces support the interaction of equipment between different manufacturers.
System equipment

- DRM+ content server
- DRM+ modulator
- Linear amplifier
DRM+ and FM transmission

- Flexibility for combined FM/DRM+ transmissions
  - Power and frequency of DRM+ block can be planned in dependency of spectrum occupancy
- Usage of DRM+ block
  - E.g. one broadcasters FM1 use one DRM+ block for one or several services
  - E.g. two broadcasters FM1 and FM2 can share one DRM+ block
The carrier frequency distance ($\Delta f$) and the power level difference ($\Delta P$) of the FM and the DRM signals can be varied flexibly.

**Recommended values**

- $\Delta f = \text{min } 150 \, \text{kHz}$
- $\Delta P > 20 \, \text{dB}$ for $\Delta f = 150 \, \text{kHz}$
DRM+ transmitter diversity

- Better reception in urban area
  - Especially at slow reception speed (2-60 km/h)
- Additional power amplifier and antenna
DRM+ test equipment

- Transmitter site
  - DRM+ content server (FhG)
  - DRM+ modulator/exciter (RFmondial)
  - Linear amplifier Band I and Band II (Nautel, SBS, ...)

- Receiver site
  - Prototype receivers (FhG, BOSCH, ...)
  - Hardware receivers
    - Planned for 2009 (ADI, RFmondial, ...)
Tests: Client tests: Inquiries for DRM+ Tests

- France
  - License at 64.5MHz granted in Paris
- Brazil
  - Governmental study analyzing DRM+
  - If positive outcome, DRM+ tests anticipated
- China
  - Delegation has visited Europe
  - Preparation of digital strategy for government
- Russia
  - Governmental study analyzing and testing DRM+ (OIRT/Band II)
- Further inquiries
  - Italy, Canada, Ukraine, India, Luxemburg, Australia, Norway …
Conclusion

- DRM+ is an spectrum efficient system
  - Only 96 kHz bandwidth
- Frequency range up to 174 MHz including
  - 47MHz to 68MHz (analogue TV Band I)
  - 65.8MHz to 74MHz (OIRT FM band)
  - 76MHz to 90MHz (Japanese FM band)
  - 87.5MHz to 107.9MHz (FM Band II)
  - 108MHz to 130 MHz (China)
- DRM+ guarantees coexistence with FM
- DRM+ up to 4 programs with good sound quality
- DRM+ is an open standard
Thank you!

waal@ikt.uni-hannover.de
Institut of Communications Technology
Appelstr. 9A
30167 Hannover