

Update on studies and field trials concerning DRM+

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Introduction

DRM+ contributions from Hannover and Kaiserslautern

Ideas about Band III

Field trial results

Status System Evaluation DRM+

DRM+ transmitter and receiver equipment

RFmondial

Spin-off of Leibniz University of Hannover, Germany

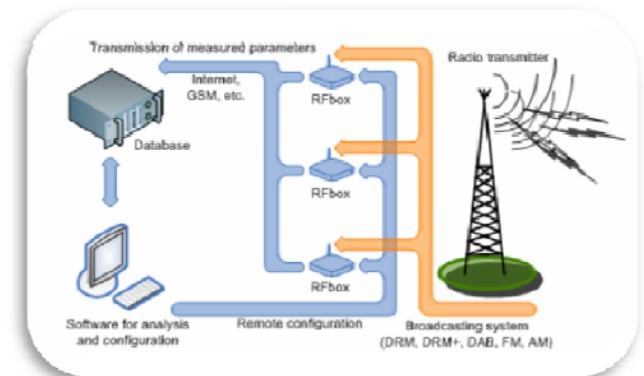
- DRM Member
- Lead of DRM System Evaluation Group
- DRM Executive Board Member

Products

- Monitoring system for digital broadcasting
- DRM+ modulator/exciter: standard, TX-diversity, SFN
- DRM+ receiver: fixed/floating point software and professional Band I,II,III digital frontend

Consulting

- Technology consulting for digital broadcasting
- Scenario analysis for decision support
- Support for transmitter configuration
- DRM/DRM+ test strategy support



DRM/DRM+ contributions from Hannover

→ History

DRM

- Field test of DRM for local coverage: field strength, mobile and long term measurements.
- Sky wave propagation simulations

DRM+

- Worldwide first DRM+ transmission in 2007
- Real-time DRM+ transmitter and receiver setup
- Compatibility test with FM-radio, aircraft and emergency services
- Protection ratio measurements for FM disturbed by DRM+
- System Evaluation Group lead



DRM/DRM+ contributions from Hannover → Ongoing

DRM

- Field test of DRM for local coverage
 - Prediction applicability of ITU-R P.1546

DRM+

- Project together with private regional radio broadcasters and Bosch
 - Transmit delay diversity and SFN field trials
 - Mobile reception and coverage measurements
 - Business case and content implementation
- Field test in Band III
- Cross-compliance of Tx / Rx hardware
- DRM+ demonstrator → please see outside



► *DRM+ in VHF Band II: Compatibility Summary*

■ **Narrowband FM BOS services (74.0 – 85.0 MHz):**

The 'Zentralstelle für Polizeitechnik (ZPT)' did own measurements.
Result:

- ✓ Lab PR measurements confirmed
- ✓ No impact in the field observed (near/far to DRM+ TX)



■ **FM sound broadcasting (87.5 – 108.0 MHz):**

- ✓ Lab PR measurements confirmed by extensive field tests
- ✓ **DRM+ can be operated without harming existing FM systems**
- ✓ **DRM+ can be planned relying on legal planning procedures**



■ **Aeronautical radio services (VOS & ILS; 108.0 – 117.95 MHz):**

- ✓ The 'Deutsche Flugsicherung (DFS)' did not carry out own field measurements, but lab PR measurements were promising
- ✓ No feedback from Ramstein (American Airforce Airbase)



Download the detailed reports from our site <http://www.drm-radio-kl.eu>

► *DRM+ in VHF Band II: Coverage Summary*

■ **As compared to FM, DRM+**

- ✓ has a substantially higher **coverage** and **coverage reliability** within the coverage area,
- ✓ is by far more **resistant to interference** (to both DRM+ and FM interference),
- ✓ shows a better and **stable mobile reception** within it's coverage area.



■ **DRM+ coverage** can be **interchanged** with **DRM+ TX power**.

- **Network Planning exercises** propose that **DRM+ SFNs**, based on high power FM GE84 TX stations, could be deployed into the existing FM environment in VHF Band II in a **compatible way**.



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- Work on our **proposal for a comprehensive DRM+ network planning recommendation** in progress.



► *The future of VHF Band III for broadcasting services*

The future of DAB in VHF Band III

- VHF Band III (174 – 230 MHz) is uniquely assigned to **digital sound broadcasting**.
- with DAB+ in MPEG-4 an average of 16 digital sound programmes can be broadcasted in one DAB multiplex signal; therefore less 'layers' are needed for the same bundle of sound programmes as with DAB in MPEG-1.
- DMB (also DVB-H) had failed in the market for mobile broadcasting, and DVB-T2 is in approach.
- DAB cannot map **local or regional coverages** for single sound programmes.

Conclusion: The original intention of entirely filling VHF Band III with DAB will not become reality: Today, it is obvious that **only a portion of Band III will be used by DAB**. Who will use the rest – is this a potential 'Digital Dividend' for other services?

Therefore, on order to save spectrum for broadcasting services:

Is it possible, that single radio stations with clear regional and/or local focus could be planned as DRM+ stations in appropriate free DAB blocks?



► *Short-list of non-technical advantages*

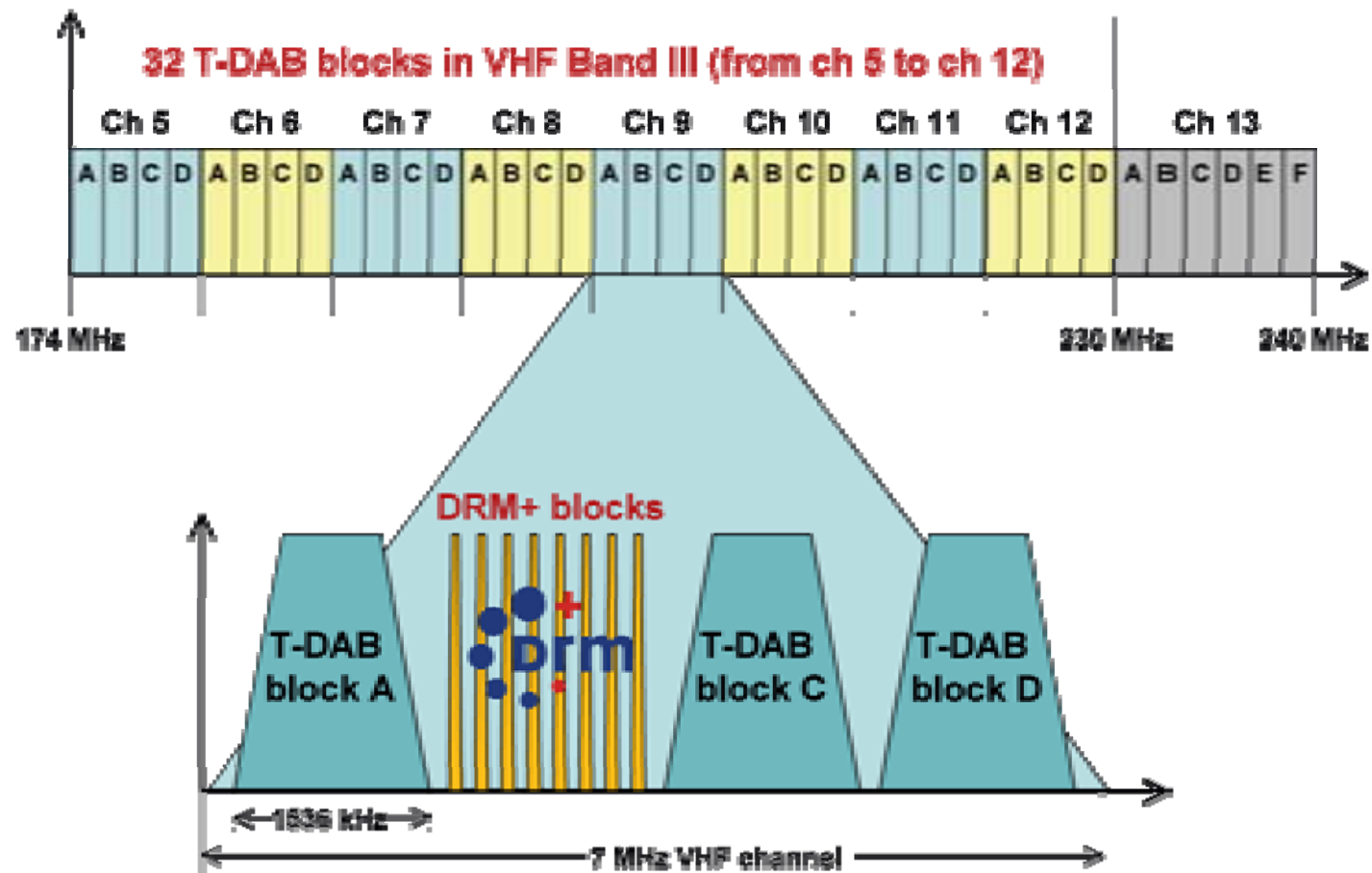
Some big advantages of DRM+ in VHF Band III

- The non solved **legal** and still pending **compatibility testing procedures** between digital systems in Band II and the **aeronautical services** – which today prevent DRM+ from being introduced in Band II in the near future – are of minor concern in Band III, except for the upper part, i.e. for frequencies > 223 MHz.
- Since in VHF Band III, only digital systems are deployed, coordination issues are much easier to solve than those encountered if, in Band II, a mixed analogue-digital scenario becomes reality. This applies especially to **international coordination** and agreements on protecting existing FM services.
- Since the DAB family and DRM+ have a great technical deal in common, i.e. MP4-AAC, OFDM modulation, ..., building **cost efficient digital RX** should be possible.

So: It's worth having a look at DRM+ in Band III!



► T-DAB frequency blocks VHF Band III



► *Current work with DRM+ in VHF Band III*

Objectives of PR measurements and field trials with DRM+ in VHF Band III

- ✓ **Validate the use of DRM Mode E (DRM+) in VHF Band III, esp. for portable and mobile reception.**



Status: Hardware-in-the-loop simulations according to Mode E profiles finished;
DRM+ can be used up to 230 MHz; *SFN needs further consideration.*

- **First fundamental PR measurements to evaluate compatibility issues.**

Status: The equipment is now complete, the work has begun!

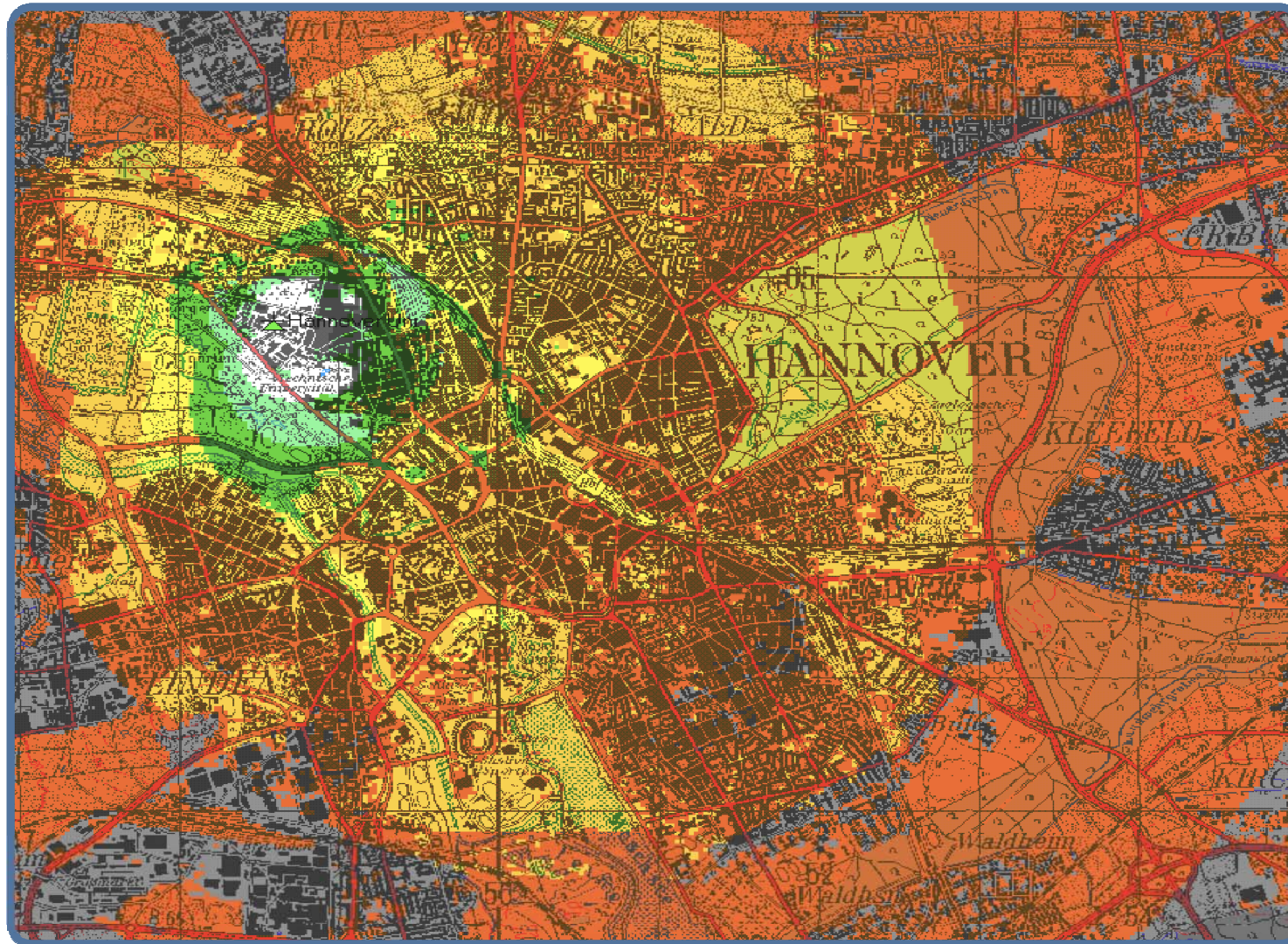


- **Conduct field trials (using the existing sites) to**
 - validate the mutual interference potential in the field,
 - Perform both fixed and mobile measurements to assess coverage issues.

Status: Licenses are granted (Blocks 10A/B/C); 100W ERP for both DAB & DRM+;
equipment now complete, the trials will begin after PR measurements.

DRM+ field trials

→ Simulation results



$[dB\mu V/m]$



$\geq 60,0$

$\geq 54,0$

$\geq 48,0$

$\geq 42,0$

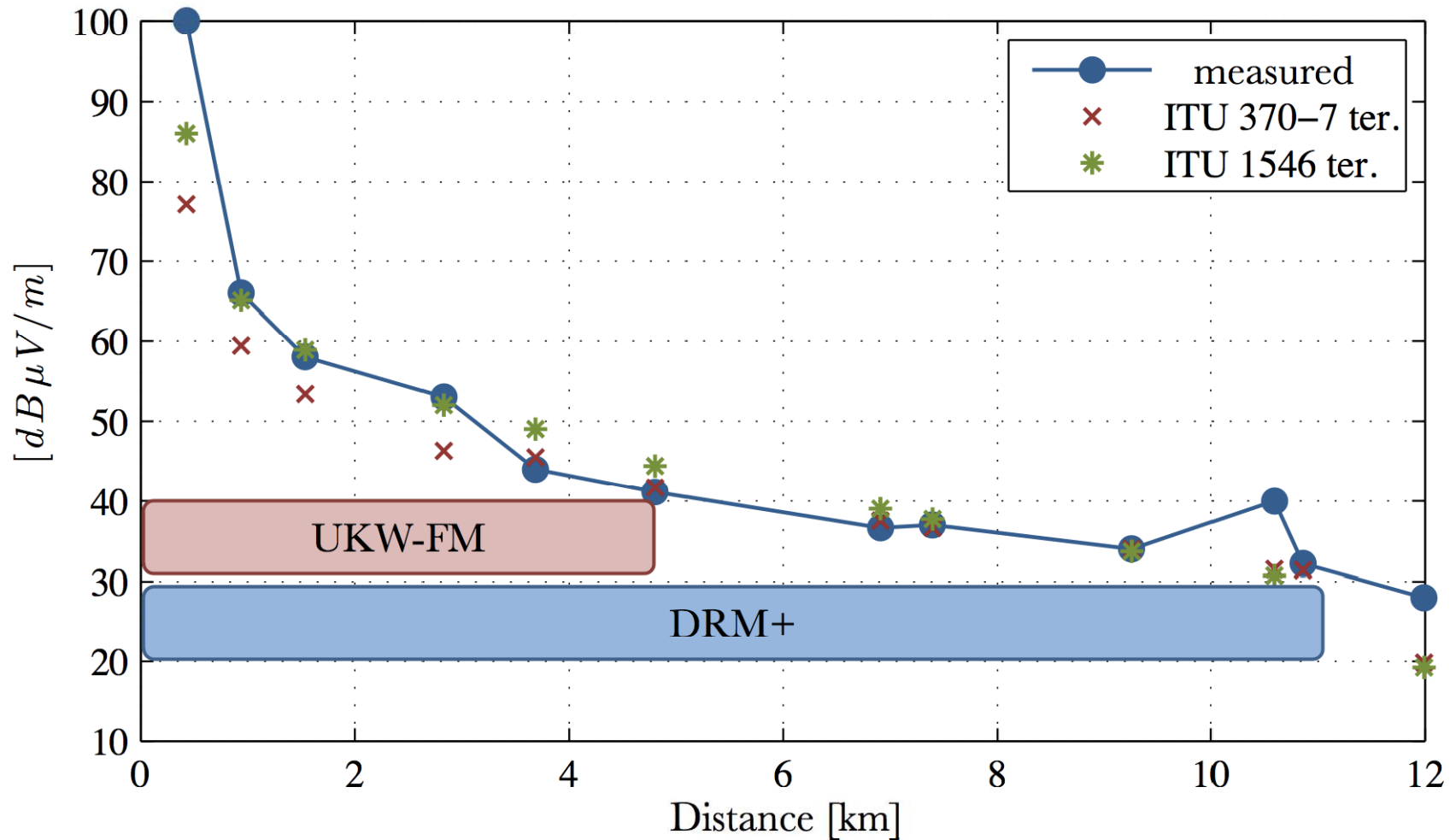
$\geq 36,0$

$\geq 30,0$

$< 30,0$

DRM+ field trials

→ Field test results



DRM+ Status

→ System Evaluation

Baseband cross compliance tests

- Successfully finished
- Fraunhofer, Bosch, FH Kaiserslautern, Analog Devices, RFmondial, LUH

Field tests with low power TX ($<100\text{W}$)

- Promising results from Hannover and Kaiserslautern
 - Coverage and coverage reliability increased compared to FM
 - No impact on other systems (FM, flight security, emergency)
 - Higher resistance to interference
- Further activities
 - Network planning recommendation for DRM+
 - Update of DRM Broadcasters User Manual to DRM+

DRM+ Status

→ DRM+ in the field

Europe

- Germany: Ongoing field trials in Kaiserslautern and Hannover incl. Band III
- France: Field trial in Band I in Paris in July, another planned in Band II
- Italy: Preparing field trial in Band I & II in combined mode

Brazil

- Governmental high power (~3.5kW) field trial currently ongoing in Sao Paolo

Russia

- Governmental study analyzing and testing DRM+ (OIRT/Band II)

China

- Preparation of digital strategy

Further inquiries for Band I and Band II

- Canada, Chile, Korea, Ukraine, India, Luxemburg, Australia, Norway, ...

DRM+ Equipment

→ Receiver site

Prototype receivers

- Fraunhofer, Bosch, FH Kaiserslautern, University of Hannover ...



Measurement receivers (RFmondial)

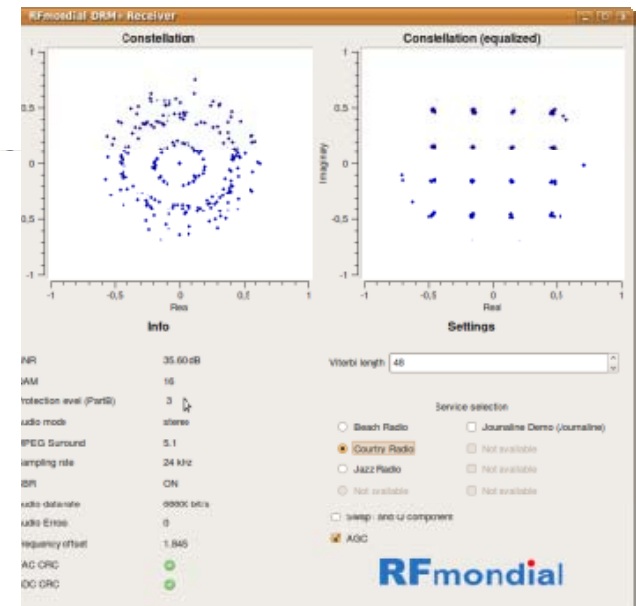
Hardware solutions

- Planned for 2009/2010 (Analog Devices, Uniwave, ...)

Receiver source code available for licensing

- Fixed & floating point (RFmondial)

Monitoring System for DRM and DRM+ (RFmondial)



DRM+ Equipment

→ Transmitter site

Professional equipment available

- DRM+ transmitter up to 44kW for Band I & II
 - ContentServer (Fraunhofer)
 - Modulator (RFmondial)
 - Transmitter (Nautel)
- Other transmitter manufacturers show interest
- Linear amplifiers/ excitors for Band III
 - DAB equipment



Conclusion

DRM+ is ready

- Standardization finished
- System evaluation finished
- Test systems available

→ You are welcome to visit the DRM+ demonstration outside.

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