DRM+ Tests and Trials
16th February 2011

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DRM is now a well known digital radio standard
- Extensive testing and evaluation for LF, MF, HF
- Regular services on air globally
- Use as a distribution means by RNZI to Pacific Islands
- Major roll-out scheduled for India

DRM+ is the extension of DRM to the VHF bands
- ETSI DRM system specification including DRM+ published in 2009
- ITU adoption into ITU-R Rec. BS.1114 proceeding
- Evaluation of DRM+ is underway
 DRM+ Evaluation

- Germany, Kaiserslautern (2008-2010) band II and III
- Germany, Hannover (2008-2011) band II and III
- Brazil, Sao Paulo (2010/11) in band II
- Sri Lanka, Colombo (2010) in band II
- Italy, Turin (2011) in bands I and II
- UK, Edinburgh (2011) in band II
Hannover, Germany

- Operating on 95.2 MHz
  - Verification of technical DRM+ parameters
  - Compatibility testing with FM-radio, aircraft and emergency services
  - Protection ratio measurements for FM disturbed by DRM+
  - Transmit delay diversity and SFN field trials
  - Mobile reception and coverage measurements
Hannover: location map; DRM+ erp of 30W
Hannover: Railway station; 16-QAM, R=0.5

Field strength

Audio quality
Hannover: Sudstadt; 16-QAM, R=0.5

Field strength

Audio quality
Hannover: 4-QAM, R=0.33; field strength
Hannover: 4-QAM, $R=0.33$: audio quality
Colombo, Sri Lanka

- Operating on 87.6 MHz, 47 W
  - Using existing radio station SLBC City FM
  - 2-day trial 29th and 30th November 2010
  - Mobile reception and coverage measurements
Colombo, field strength predictions

• Radiomobile: Longley Rice Prediction Model, Topographic data, but no morphology (therefore optimistic)
• 95% of locations and time, 50% time
• Power: 47 W
Colombo: route to the north

Good reception up to a distance of around 9 km
Colombo: route to the south

Good reception up to ~5 km

Period of drop out when passing a strong interferer (Real Radio on 87.8 MHz @ 2.5 kW)
Good reception up to ~7 km

Period of drop out when passing a strong interferer (Max Radio on 90.6 MHz @ ? kW)
Colombo: route to the south-east

Good reception up to ~9 km
UK Trial Requirements

- Complementary to other trials conducted and underway
- Provide data for international regulatory work
- Representative environment for “commercial” services
  - Realistic power level
  - Good range of physical environments
    - Urban, suburban, rural
  - Partners willing to make it happen
UK Trial Partners

- DRM Consortium – steering and coordination
- UK Ofcom – T&D license
- Nautel – NV5 transmitter
- RFMondial – DRM+ modulator and monitoring receiver
- Fraunhofer – content server
- KETI – check receiver
- Arqiva – transmission site, antenna, installation and commissioning
- BBC project management, measuring, analysis
UK Trial Objectives

- To measure the coverage of DRM+ operating in various transmission modes (lower capacity, higher ruggedness; higher capacity, lower ruggedness);
- To compare the coverage of FM and DRM+ in terms of transmit power;
- To assess the impact of DRM+ on FM and vice-versa;
- To demonstrate the performance of DRM+ in a good range of environments throughout the coverage area, for example, urban, suburban, rural, etc., and therefore provide an analysis of performance in the presence of multipath interference, terrain shielding, man made obstructions, etc., in both strong and weak signal areas;
- To measure the pattern of the antenna in order to correlate performance in different directions with expected performance;
- To provide suitable measurement data to international regulatory bodies, such as CEPT and ITU.
UK Trial Location - Edinburgh
UK Trial Parameters

- **RF parameters**
  - Using existing 10 kW FM assignment
  - 1 kW erp DRM+ power, mixed polarisation
  - 107.0 MHz

- **OFDM parameters**
  - 4-QAM, \( R = 0.33 \) -> ~ 50 kbps payload
  - 16-QAM, \( R = 0.5 \) -> ~150 kbps payload

- **Service parameters**
  - 4-QAM
    - 1 audio service - BBC Radio nan Gaidheal @ ~ 45 kbps
    - PRBS for BER measurement
  - 16-QAM
    - 2 audio services - BBC Radio nan Gaidheal and music @ ~ 70 kbps each
    - PRBS for BER measurement
UK Trial measuring vehicle
Leith Dock - spectrum 103.5 to 107.5 MHz

Analyzer
Start Frequency: 103.5 MHz
Stop Frequency: 107.5 MHz

Ref Level: 80 dBuV
Ref Offset: 10 dB
TFR Level: 10 kHz
TFR Delay: 200 ms

File Name: Leith Dock-6000
Analyzer: Analyzer
Ref Level: 80 dBuV
Span: 4 MHz
Trig Level: Free Run
Trace Mode: Average

Channel Table
Channel: DRM
Carrier Frequency: 105.5 MHz
Frequency Offset: 0 kHz
Span: 4 MHz
Ref Offset: 0 dB
RF Attenuator: 0 dB
Preamp: Off
Display Range: Linear
Filter: No Filter
VSWR Bridge: No Bridge
RBW: 10 kHz
VBW: 10 kHz
SW: 200 ms

Date: 02/01/1995
Time: 16:34:44
Instrument: FSH23-101355
Operator: -
UK Trial, initial results 4-QAM
Conclusions

- The evaluation of DRM+ is progressing well
- Information about the trials will be submitted to the ITU
  - Adding to the information already there
  - We will recommend that the information is drawn together into a report to allow all parties to understand the capabilities of DRM+
- There is still work to do in understanding all aspects of introducing DRM+
  - DRM TC is coordinating
  - The DRM Broadcasters User Guide will be updated in due course