

DRM+ Tests and Trials

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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

- Germany, Kaiserslautern (2008-2010) band II and III
- Germany, Hannover (2008-2011) band II and III
- France, Paris (2009) in band I
- 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

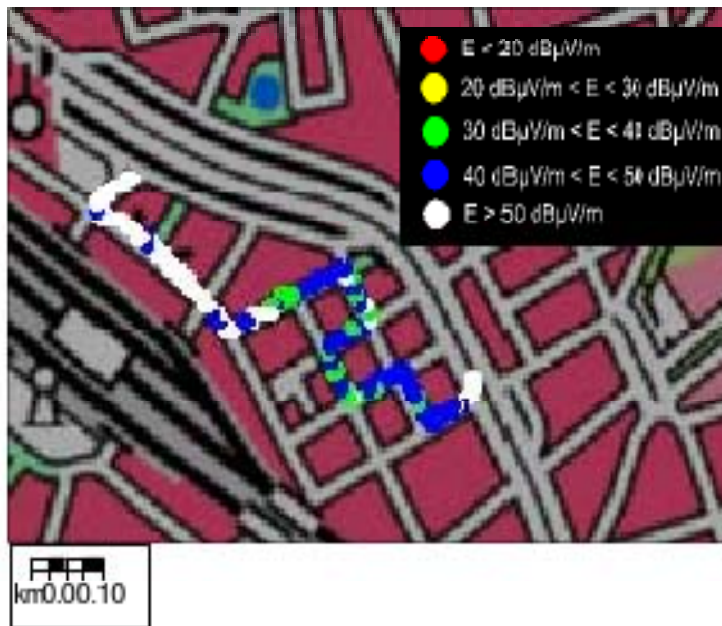
- Operating on 95.2 MHz
 - Verification of technical DRM+ parameters
 - Compatibility testing with FM-radio, aircraft and emergency services
 - Protection ratio measurements for FM disturbed by DRM+
 - Transmit delay diversity and SFN field trials
 - Mobile reception and coverage measurements



Hannover: location map; DRM+ erp of 30W



Hannover: Railway station; 16-QAM, R=0.5

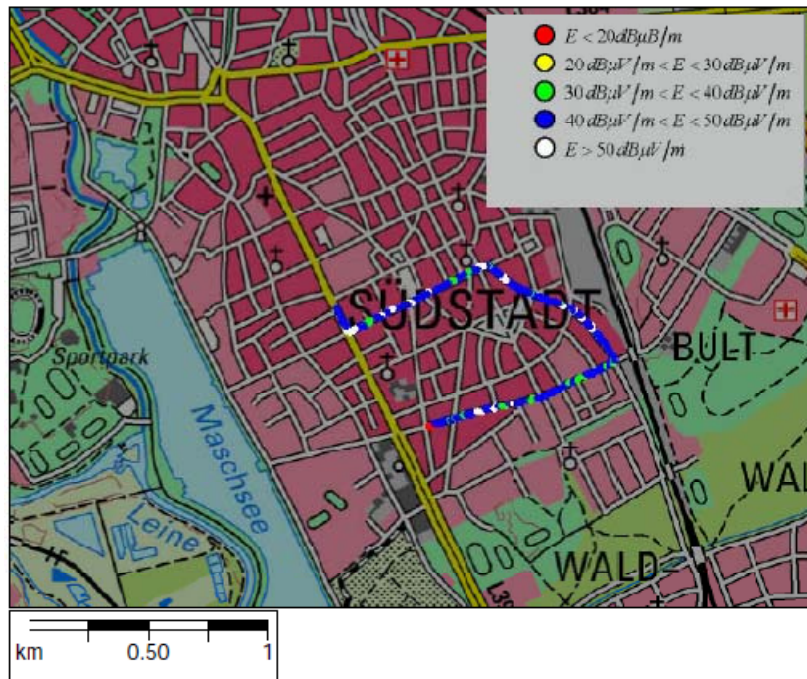


Field strength

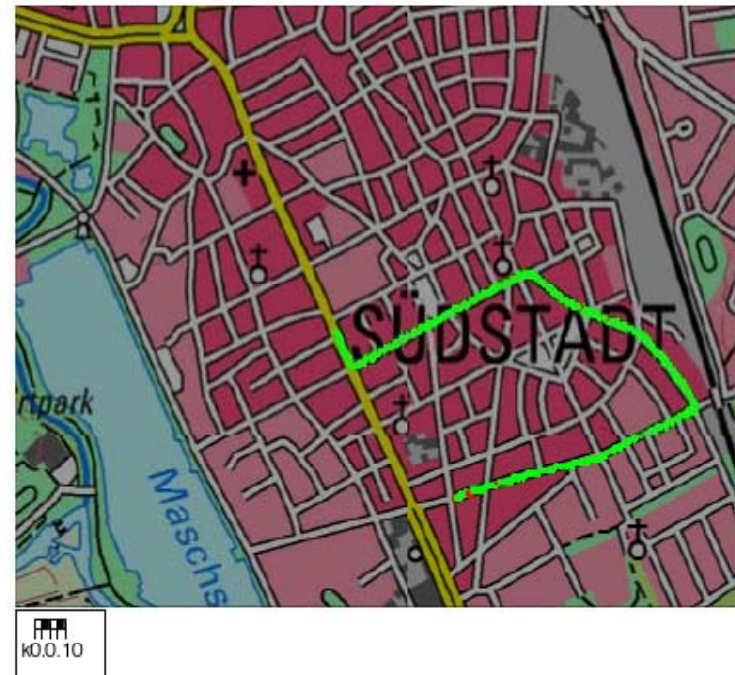


Audio quality

Hannover: Sudstadt; 16-QAM, R=0.5

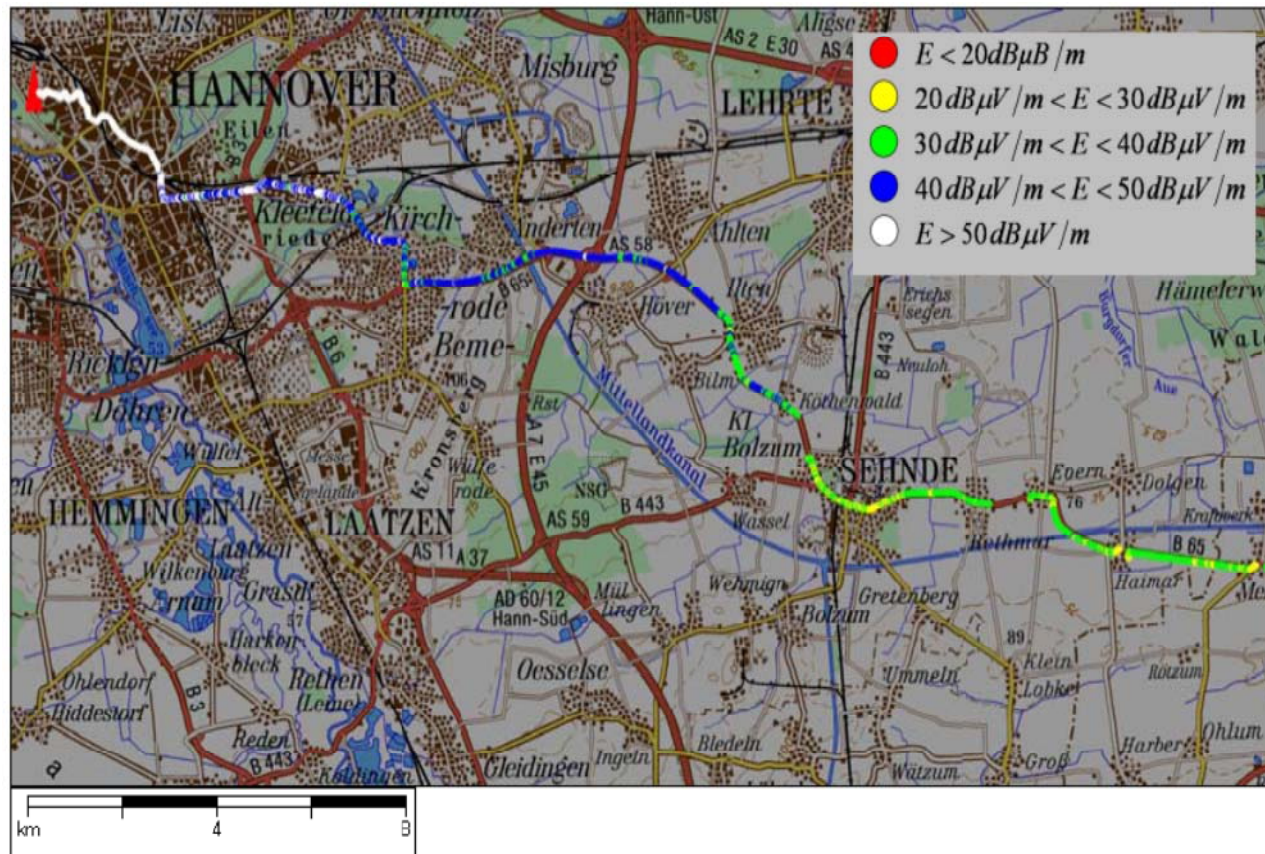


Field strength

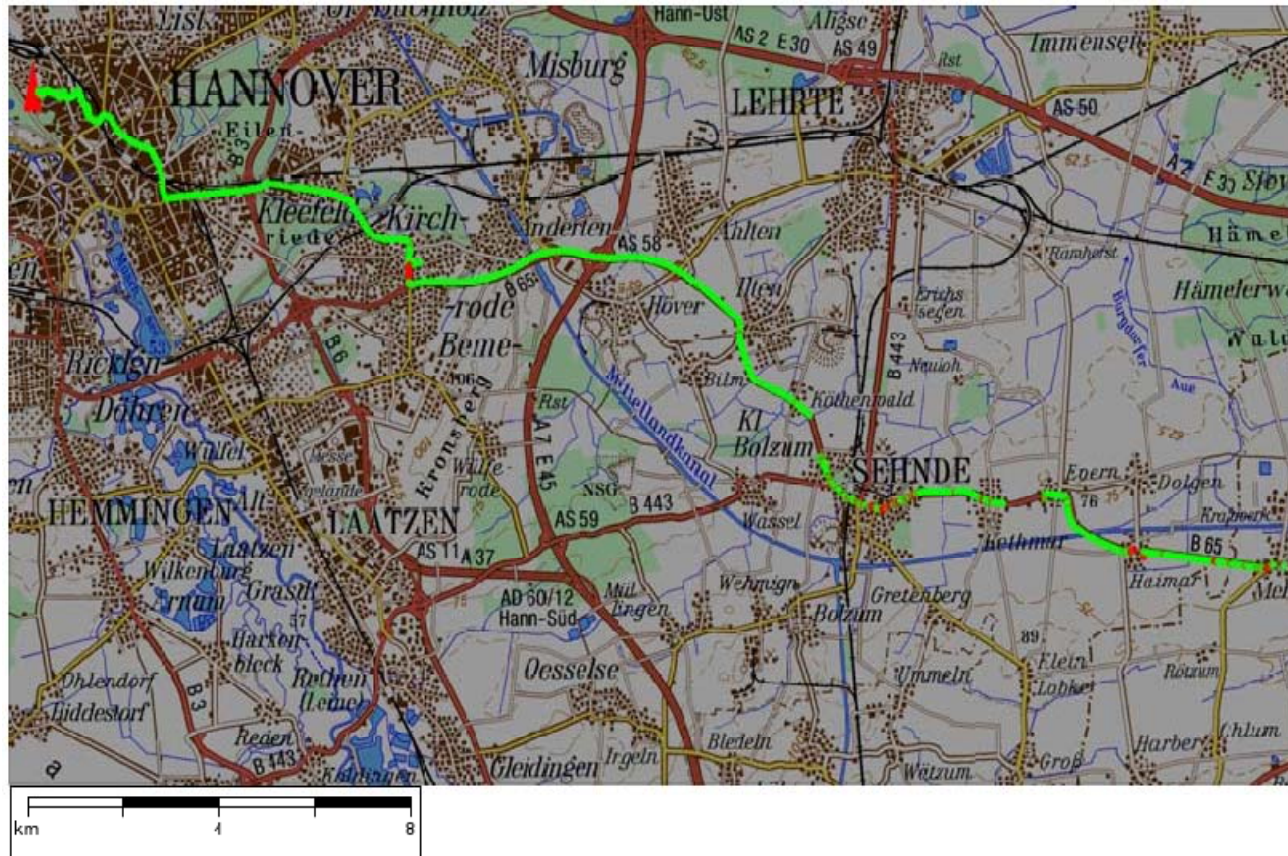


Audio quality

Hannover: 4-QAM, R=0.33; field strength

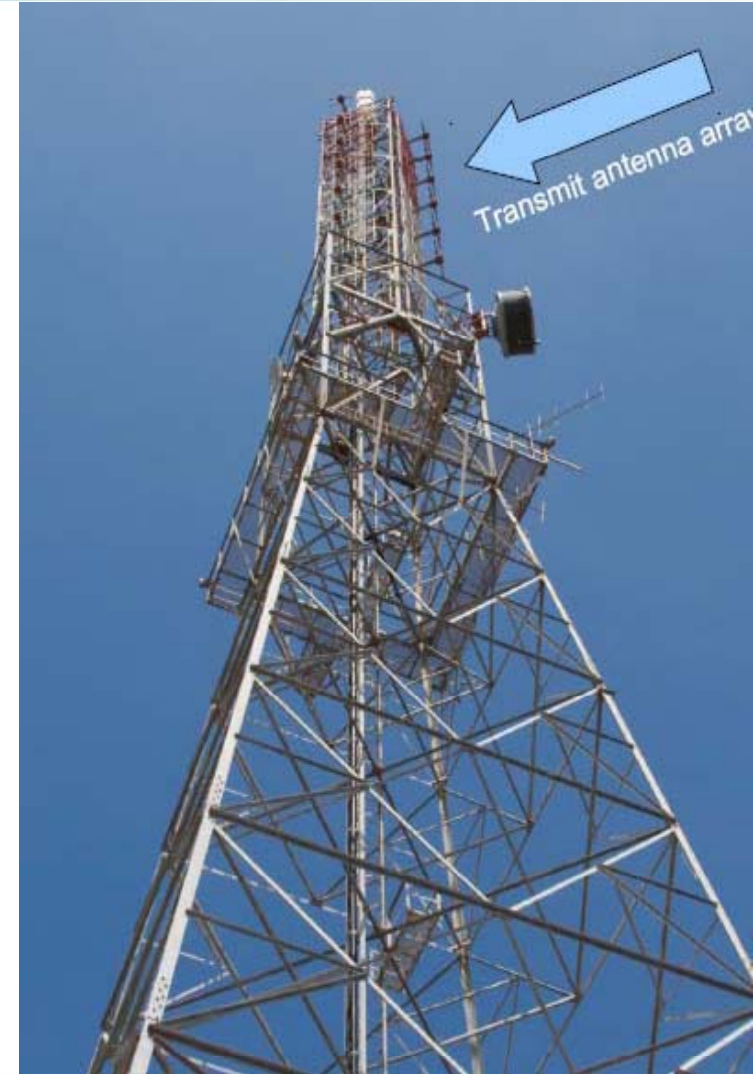


Hannover: 4-QAM, R=0.33: audio quality



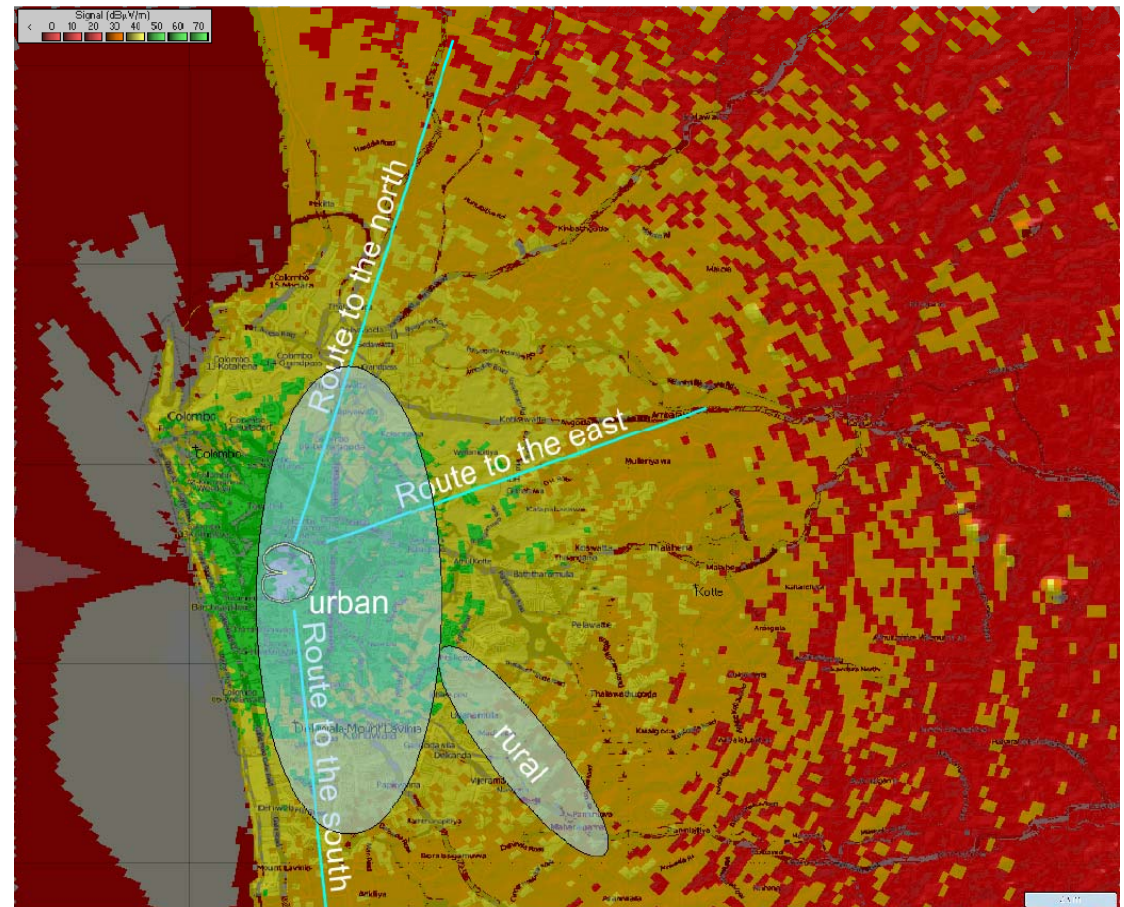
Colombo, Sri Lanka

- 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

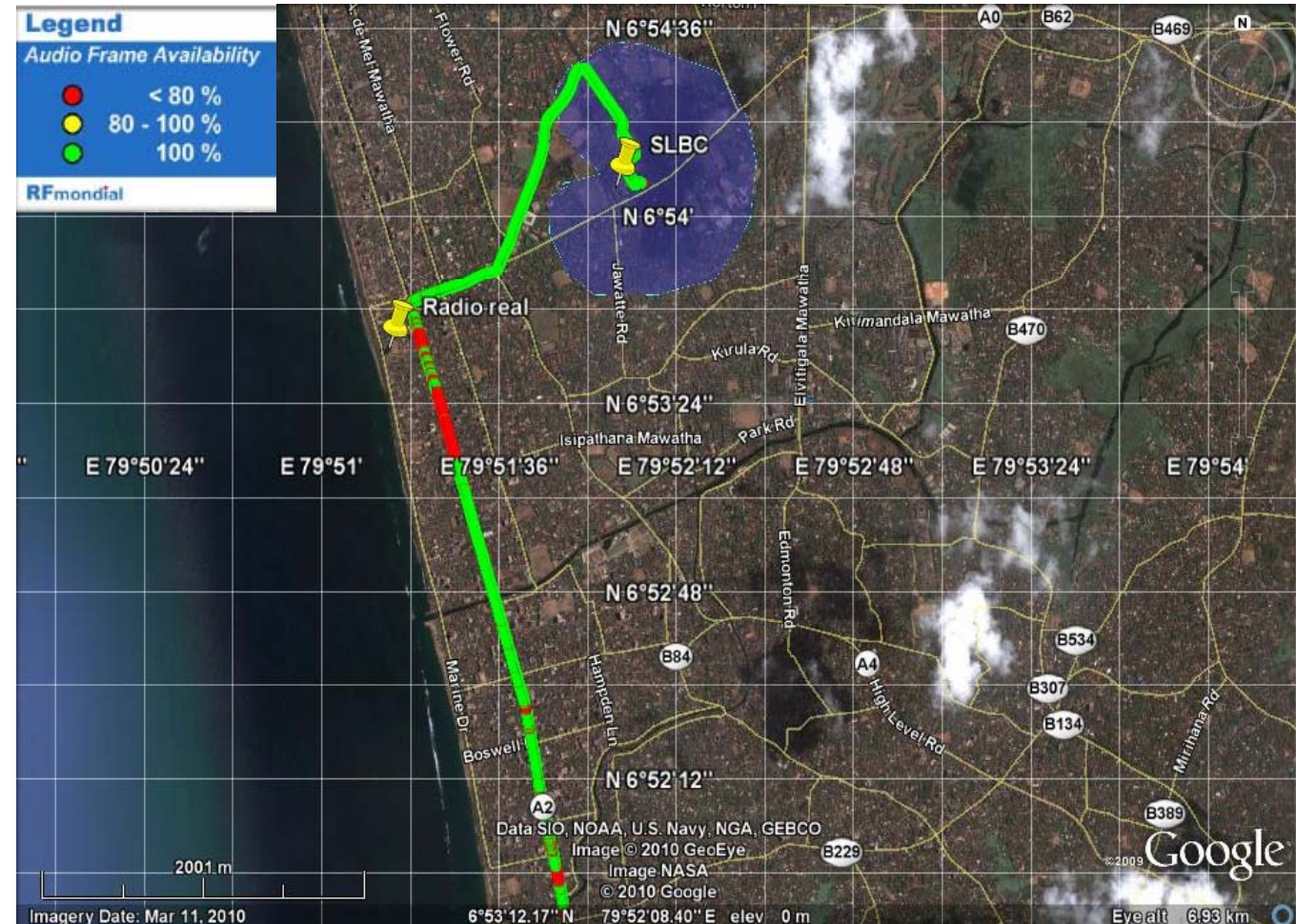
Good reception
up to a distance
of around 9 km



Colombo: route to the south

Good reception
up to ~5 km

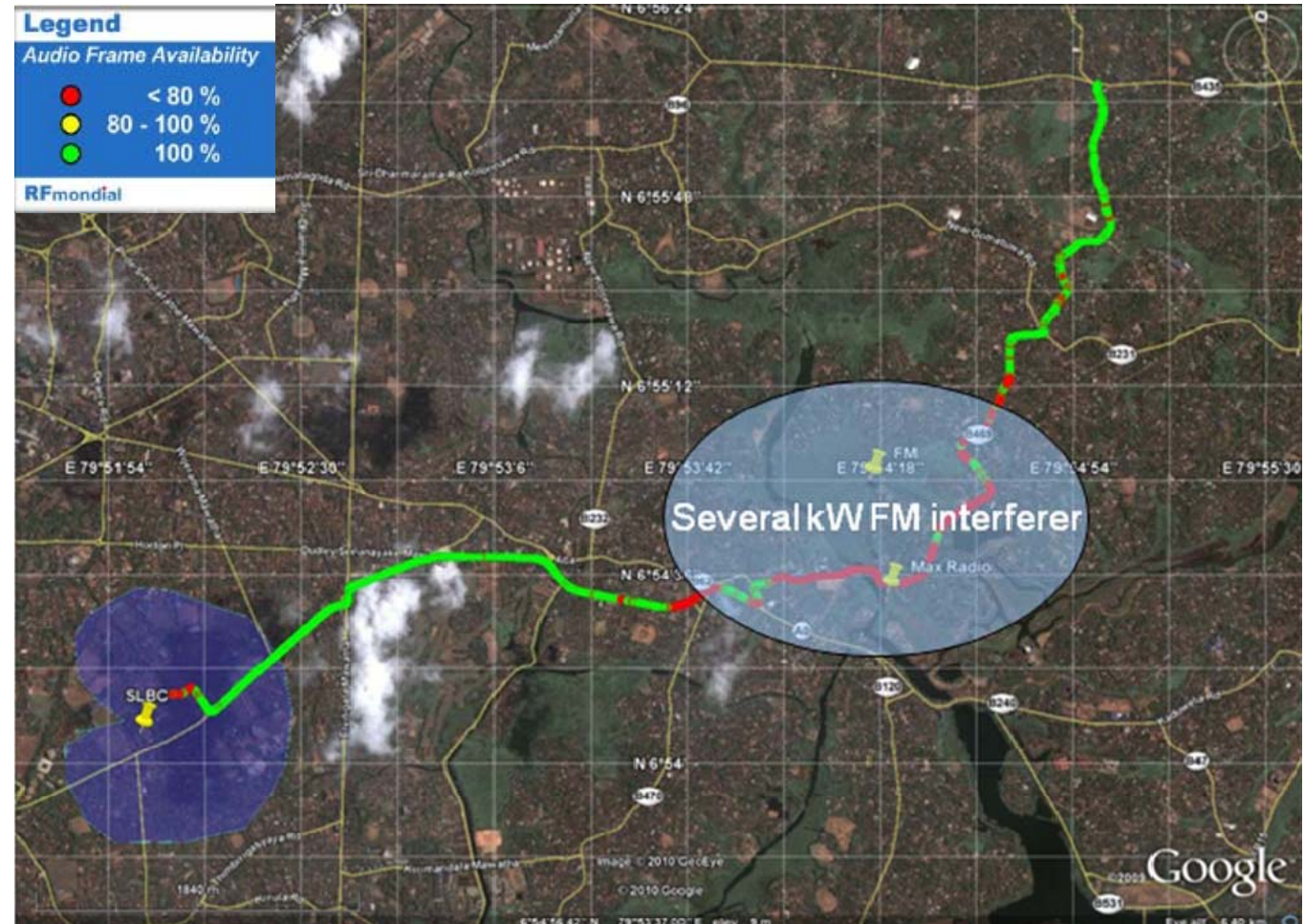
Period of drop
out when
passing a strong
interferer (Real
Radio on 87.8
MHz @ 2.5 kW)



Colombo: route to the east

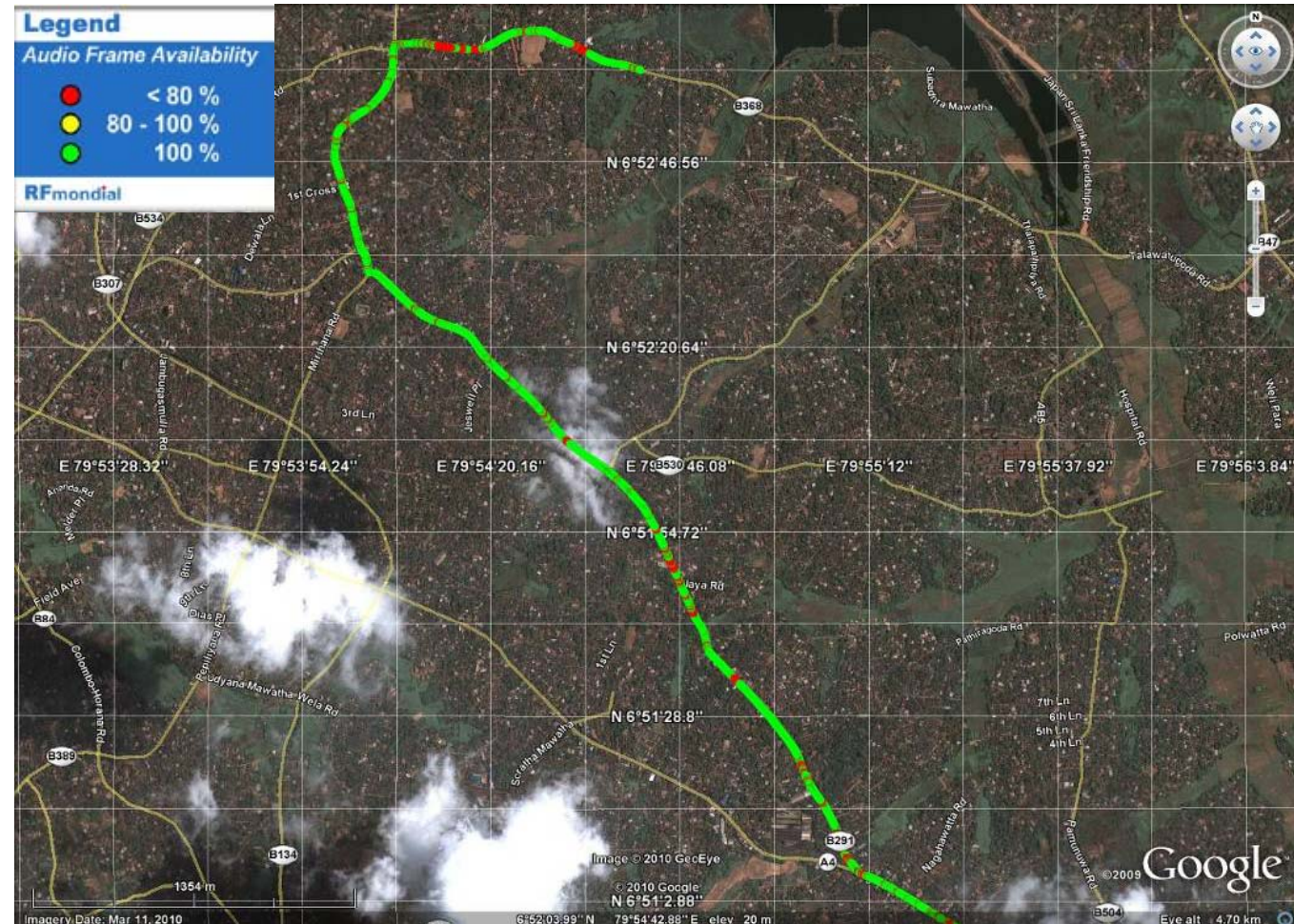
Good reception
up to ~7 km

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

- 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



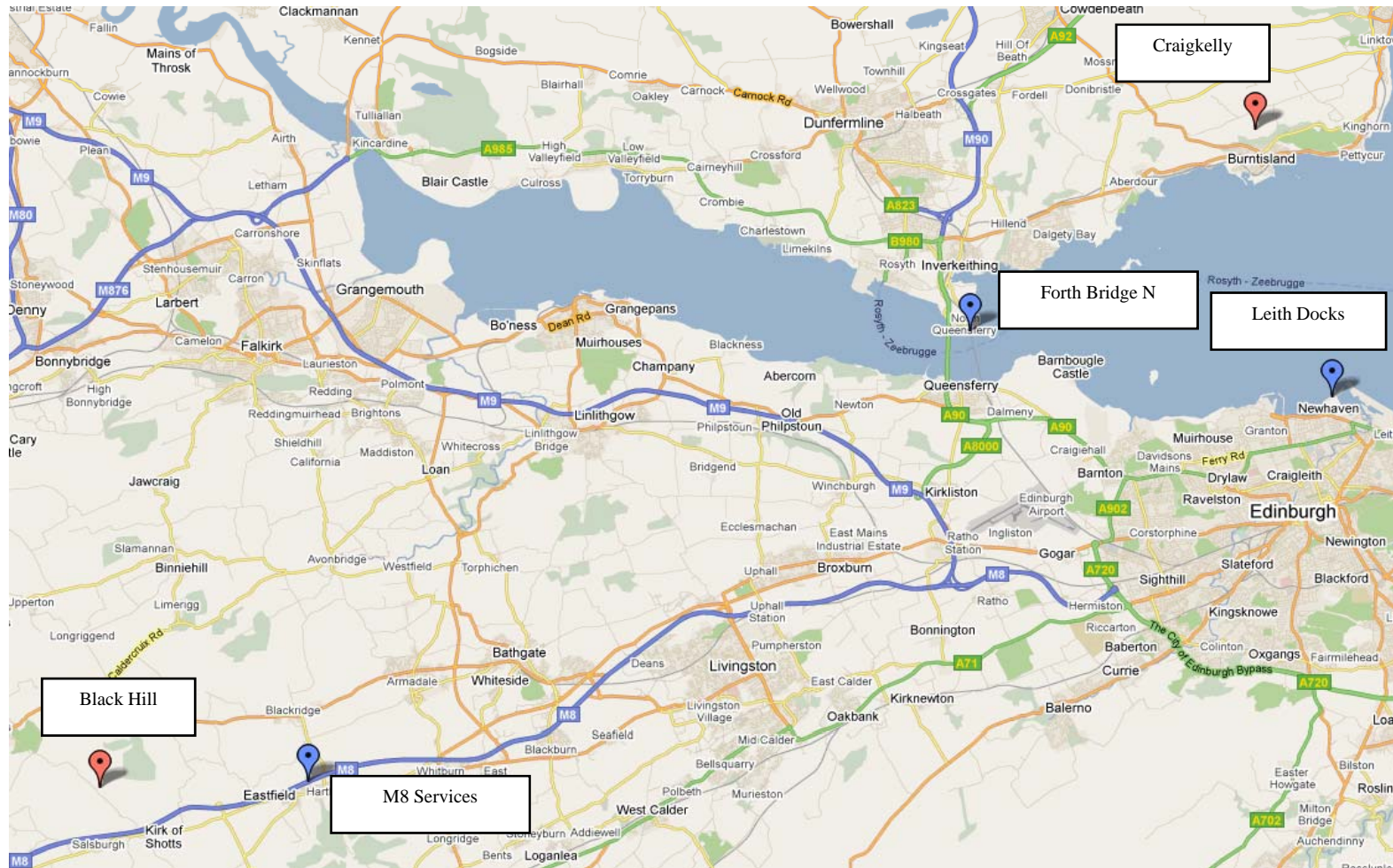
- To measure the coverage of DRM+ operating in various transmission modes (lower capacity, higher ruggedness; higher capacity, lower ruggedness);
- To compare the coverage of FM and DRM+ in terms of transmit power;
- To assess the impact of DRM+ on FM and vice-versa;
- To demonstrate the performance 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



- 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

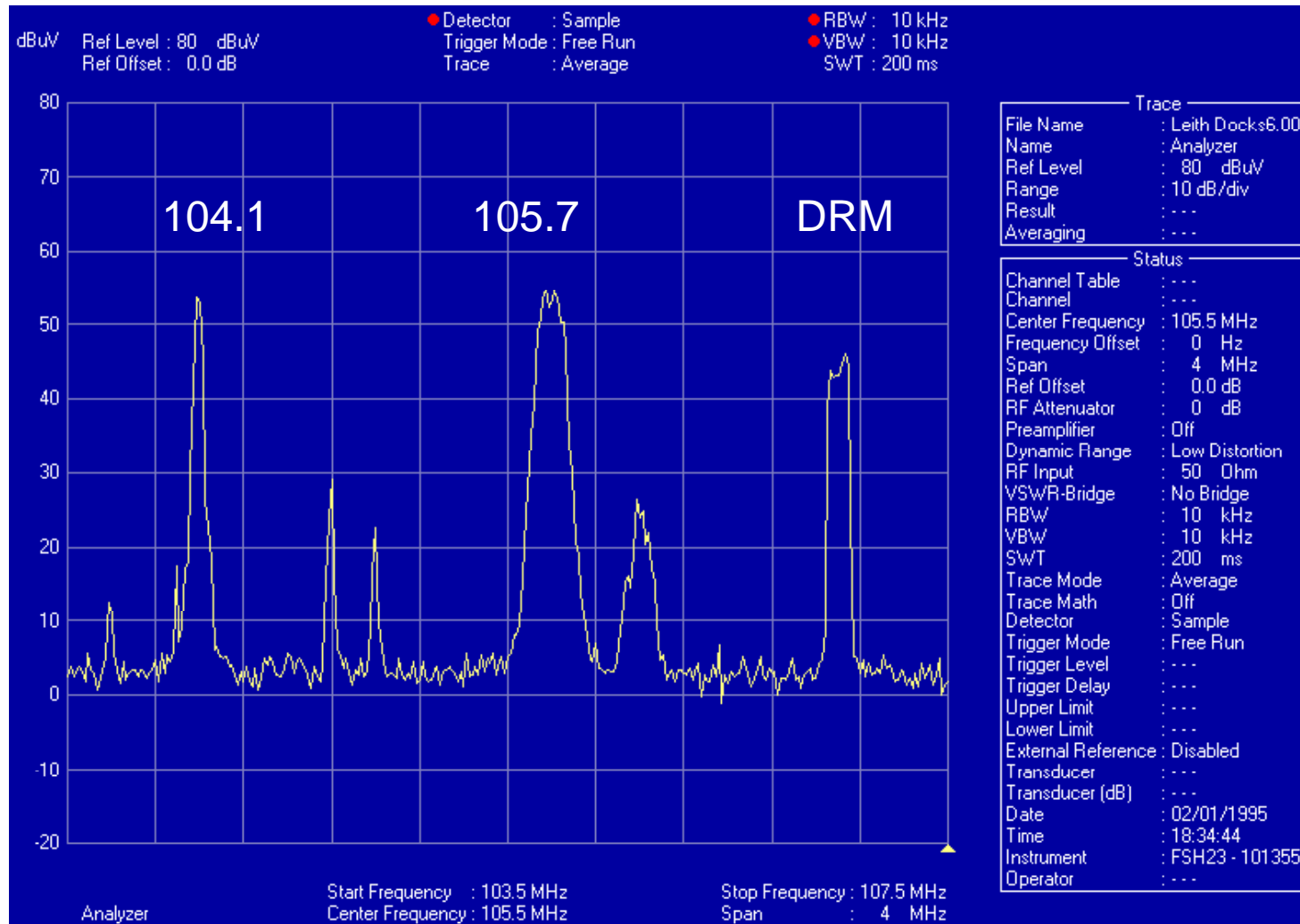
UK Trial location



UK Trial measuring vehicle



Leith Dock – spectrum 103.5 to 107.5 MHz



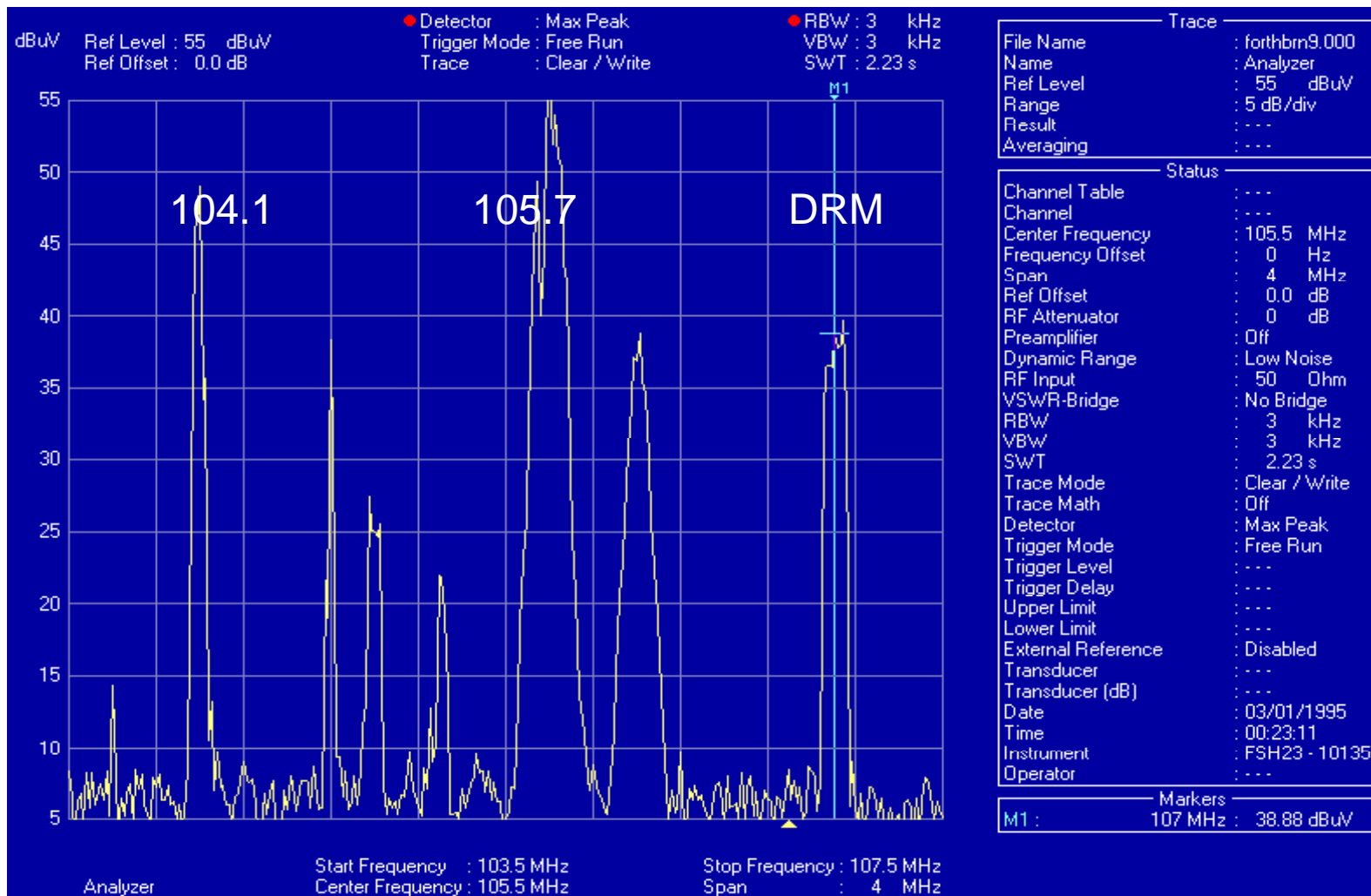
North shore



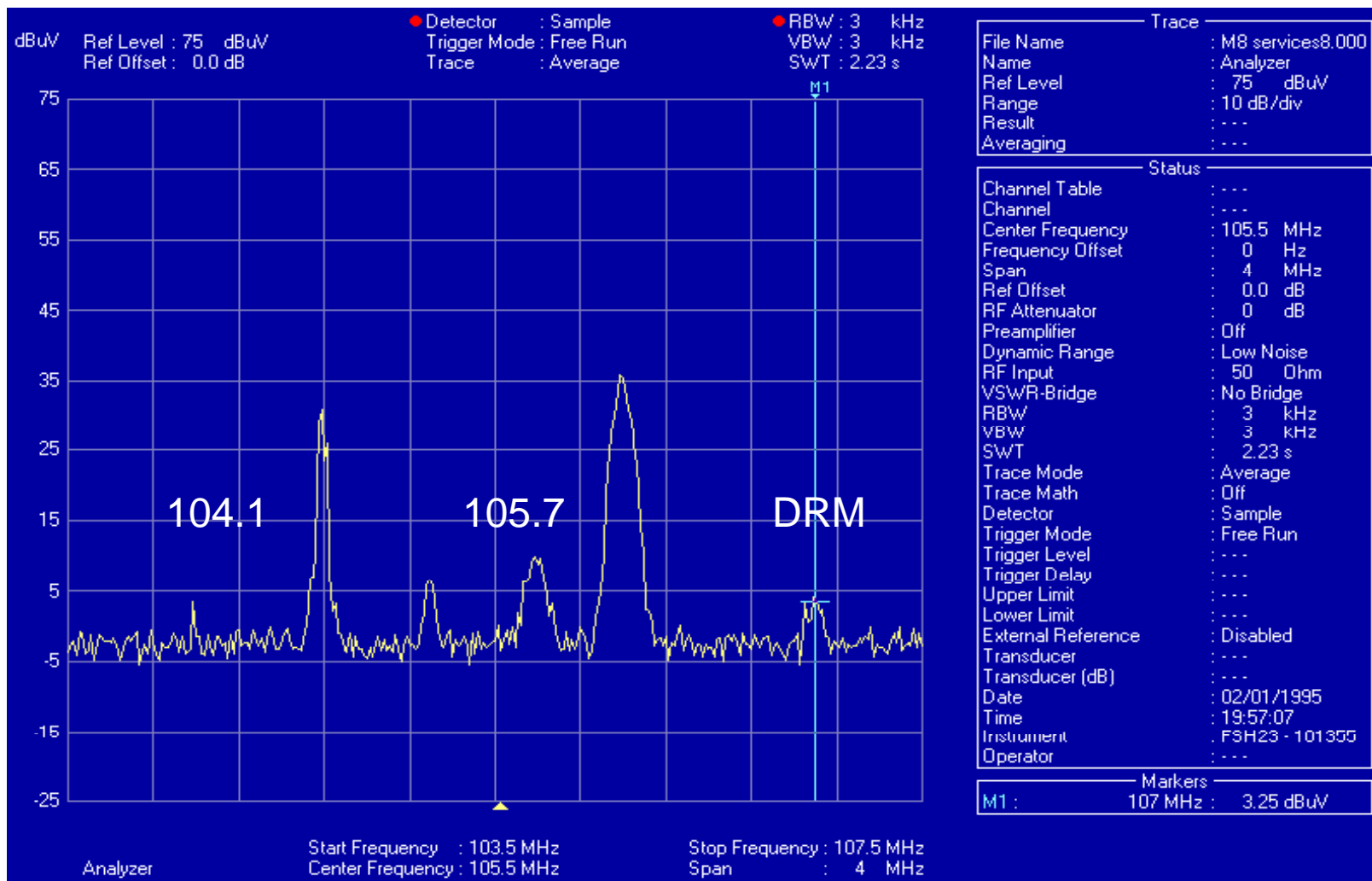
BBC

www.drm.org

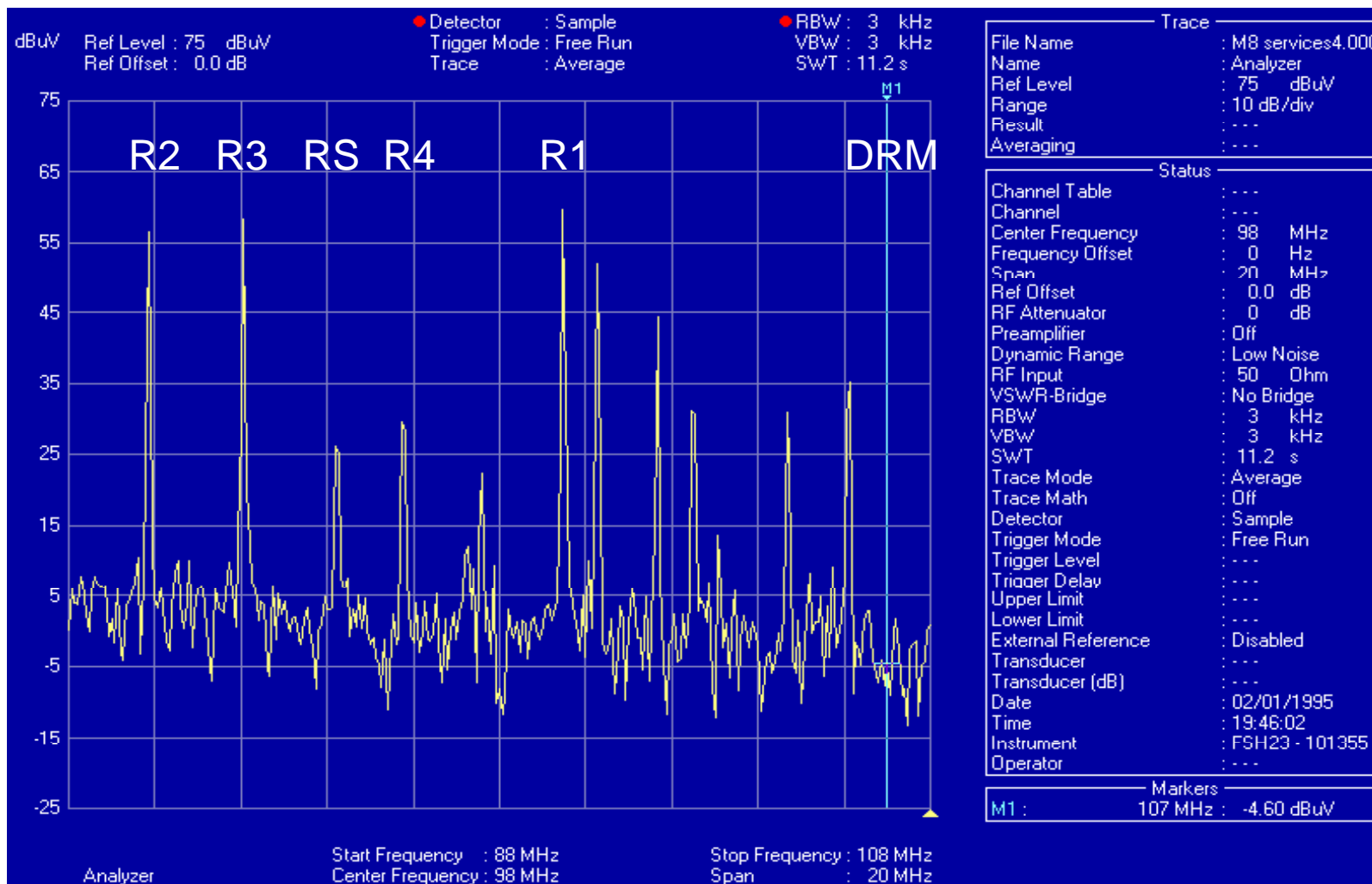
North shore



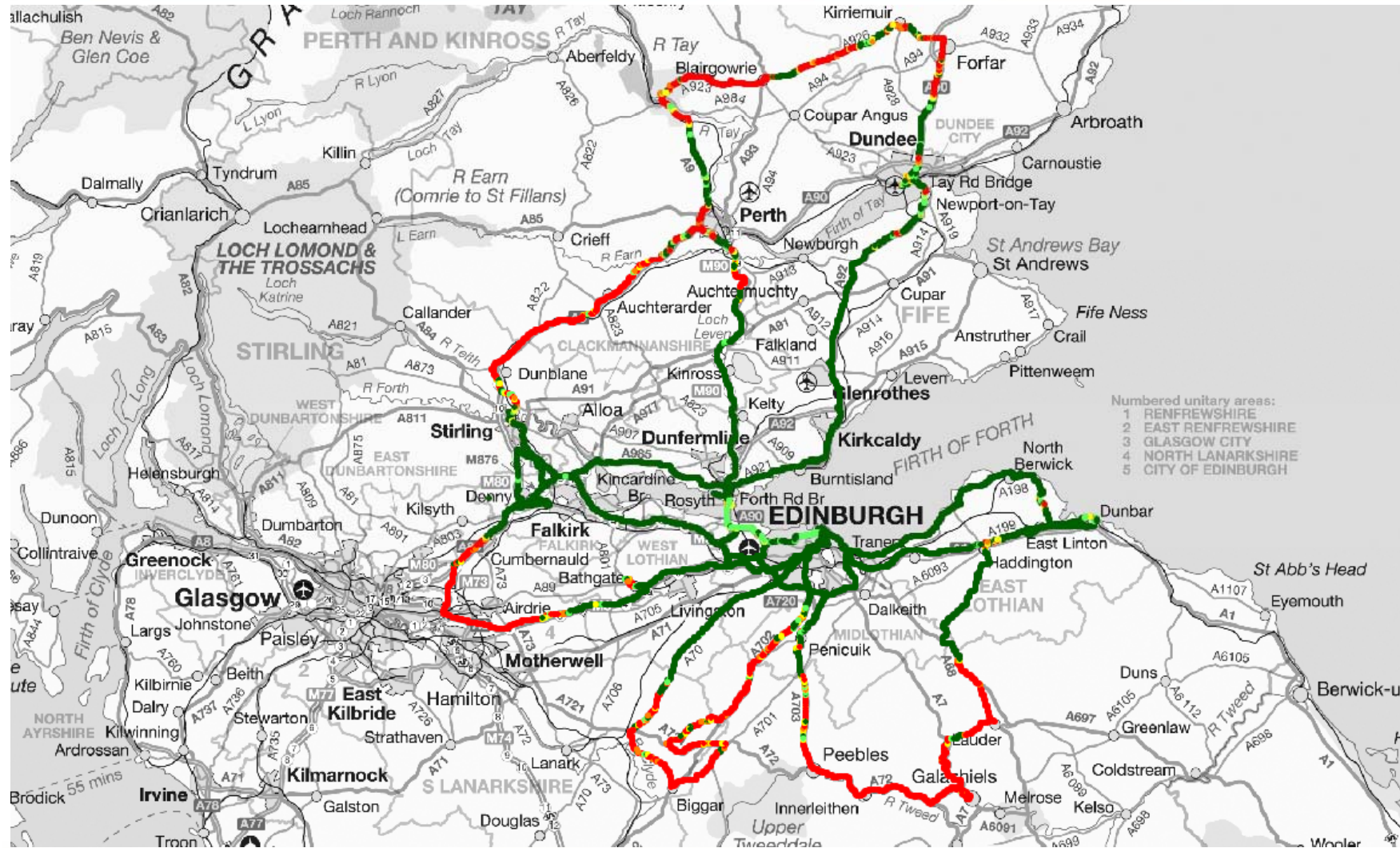
M8 services



M8 services



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