Strategic Research Requirements for Broadband Fixed Wireless Access

A Report

Recommendations on strategic research applicable to broadband wireless access resulting from a meeting held between interested parties from the Mobile and Terrestrial Propagation task group, the Fixed Links Propagation task group and the Broadband Fixed Wireless Access technical group.

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The 1st Meeting took place on 20th March 2001 and was hosted by The Radio Communications Research Unit at RAL. There were 28 Attendees including representatives from Industry, including 28 GHz operators, the Radiocommunications Agency, the RRAC, the Mobile and Terrestrial Task Group, the Fixed Links Task Group, the Broadband Wireless Technical Group, UK ITU-R SG3, Universities and Research Consultancies.

The group are specifically concerned with Broadband Fixed Wireless Access, including LMDS at 28 GHz and 42 GHz, High altitude platforms, Satellite systems (but not the MSS) and Free Space Optical links.

The following is a summary of the outcome from this meeting and subsequent discussions.

What the operators wanted

Models for propagation, like ITU R P.452 but readily codable, near 0% time to 100% time, including correlation over area and for both wanted and unwanted (interference) paths.

More data relevant to BFWA, e.g. low towers near the clutter height, long term statistics and for interference paths.

Measured real channel data to be used for testing system response in simulators.

What are the real effects of FDD/TDD interference on performance.

Tactical issues for installation e.g. Type approved equipment for 28 GHz now !

The effect of introducing a new base station into an existing deployment and how this can be managed.

Better frequency planning tools.

What the modellers wanted

There was an overwhelming wish for more measurement data, much more measurement data.

Verification testing of models, e.g. ITU-R P.452 above 30 GHz.

Cheap widely available terrain and clutter data suitable for use in ITU recommendations

A unified approach to terrain and clutter databases between the modelling community.

Data on the temporal and spatial variability of rain.

More clear air data relevant to area statistics.

More data on the correlation of propagation effects over space, time and bandwidth

More work on Mitigation techniques, including frequency scaling, fade modelling and rain cell modelling.

What the regulators wanted

Help in judging where specific issues are of commercial importance within strategic research.

Universally Agreed models for regulation, so both sides get the same results in a co-ordination issue.

Cheap widely available terrain and clutter data for use in ITU recommendations.

More work on antennas - especially smart antennas.

Studies on inter-operator co-existence and an assessment of the true effect on spectrum efficiency.

How to improve spectrum efficiency at inter-operator boundaries.

Spectrum Sharing studies.

A database of the performance characteristics and limitations of real installed equipment and services. I.e. What's out there?

Work Areas Prioritised

An extensive list of work areas was drawn up and presented to the group. I have listed these in the table below with some prioritisation. The scales are:

1 = Very High 2 = High 3 = Desirable

There are also time sensitivity to consider:

1 = Immediate 2 = 2-3 Years 3 = 3-5 years

Subject	Priority	Timescale
Propagation Models		
Update and extension of ITU-R P.452	1	1
Prediction tools for performance when antennas at clutter height	1	1
Fast computer algorithms for Monte Carlo simulations	3	2
Channel models for coherence, multipath, vegetation effects	2	2
New Measurements		
Correlation of impairments over time, space and frequency band	1	1
Effect of propagation through Vegetation	2	2
Area statistics for rainfall and Clear air effects	1	1
Long range interference at mm-wavelengths to extend Rec. P. 452 to near 0%-100% Time	1	2
Optical links	2	2
Radio System Planning and Optimisation Tools		
Area coverage planning	1	1
Optimised roll out	2	1
Performance evaluation	3	3
Spectrum Management & Efficiency Optimisation		
Co-ordination strategies	1	1
What systems are likely to require spectrum in the future	3	3
Minimisation of guard bands	1	1

Minimisation of exclusion areas	2	2
Identification of new spectrum	3	3
The implications of impairments on system design and performance		
Details of equipment characteristics in database	2	1
Real response of systems to interference/broadband effects (e.g. FDD/TDD sharing)	1	2
Required protection to other spectrum users	1	1
Models of correlation of propagation phenomena over time and space		
Area correlation of rainstorms	1	1
Simultaneous enhancement of interference and fading (e.g. rain scatter)	2	2
Interference and Sharing		
Inter-operator interference, especially at boundary	1	1
Inter-system interference- Interference limited operation	2	1
Antennas & Antenna Masks, Smart Antennas		
Are antenna masks realistic in evaluating interference with many users?	2	1
How many antennas will really be “worst case” - statistical approach?	1	1
Beam shaping to improve rain fade margin	2	3
Smart antennas to improve capacity or overcome channel impairments	3	3
Mitigation techniques		
COST280 - Impairment Mitigation Techniques (Including interference mitigation)	1	1
Use of terrain to reduce interference	2	2
Spectrum planning aim to maximise capacity through interference limited operation. (Currently, a typical co-ordination trigger is that interference must be 10dB below system noise floor.)	2	3