### **Uplink Interference Coordination/Control for 802.16m**

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Re:

TGm Call for comments on SDD, IEEE 802.16m-07/040

Abstract:

Discussed the functional of uplink interference coordination and control for 802.16m

Purpose:

Discussion and adoption of functional area into SDD outline

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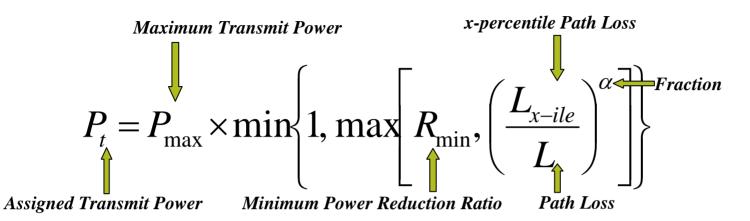
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## **UL Interference Coordination/Control**

- IoT control is critical for 802.16m
  - → MS battery life
  - Cell edge coverage/performance
- Fractional power control (FPC) compensates a fraction of the path loss and shadowing
  - Tradeoff between cell edge performance and overall sector SE
- To tightly control IoT, neighbor APs need to share uplink performance metric e.g. IoT, UL quality etc.
  - → Through Backhaul message
  - → AP then adapts the parameters of FPC formula and broadcast them to the UE's
- UL interference control can be done through
  - **⇒** Each AP sends slow updates to power control UL transmission.
    - →E.g. using UL grant message
  - → Alternatively, each MS can derive its own transmission power <u>and MCS</u> according to the path loss measurement from downlink pilot.

## Fractional Power Control Scheme



- 1> $\alpha$ >0 is the PC fraction for MSs with bad channel and MSs with good channel.
  - $\rightarrow$   $\alpha$ =0  $\Rightarrow$  All MSs transmit at full power: high interference level and poor edge performance.
  - $\Rightarrow$   $\alpha$ =1  $\Rightarrow$  Traditional slow power control: all MSs received at the same power with poor spectral efficiency.
- $\alpha$  can be adjusted based on e.g. IoT, UL performance etc. of neighbor cells for good edge coverage performance and high spectral efficiency.
  - → MSs with good channel condition transmit at relatively low power level to reduce interference level.
  - → At the same time, MSs with good channel condition are received at relatively high power level to achieve high spectral efficiency.

# System Simulation (an example)

#### • 3 reference simulation cases

Simulation	ISD	PLoss	Speed	Traffic Type	
Cases	(m)	(dB)	(km/h)	Used	
1	500	20	3	Full-buffer	
2	500	10	30	Full-buffer	
3	1732	20	3	Full-buffer	

- 10 MHz system bandwidth
- 10 mobiles per sector with 8 maximum scheduled per 0.5ms sub-frame

Pa	arameter	Assumption		
Cellular Layou	t	Hexagonal grid, 19 cell sites,		
Inter-site dista	ance (ISD)	3 sectors per site 500m, 1732m		
Distance-dependent path loss		L=I + 37.6log <sub>10</sub> (.R), R in kilometers I=128.1 - 2GHz		
Lognormal Sh	adowing	Similar to UMTS 30.03, B 1.41.4		
Shadowing sta	andard deviation	8 dB		
Correlation dis	stance of Shadowing	50 m		
Shadowing	Between cells	0.5		
correlation	Between sectors	1.0		
Penetration Lo	OSS	10, 20dB		
Carrier Frequency		2.0GHz		
Channel model		Typical Urban (TU)		
UE speeds of interest		3 & 30 km/h		
Total BS TX power		43dBm		
UE power clas	SS	24dBm		
Inter-cell Interference modeling		UL: Explicit modelling (all cells occupied by UEs),		
Min distance between UE and cell		>= 35 meters		

## Comparison of PC Schemes

	Sector Throughput (Kbps)			5%-ile User Throughput (Kbps)		
Case	Fractional PC	Regular PC	Full Power	Fractional PC	Regular PC	Full Power
1	7294	5892	7424	172.5	187.1	92.6
2	7452	6288	7199	209.0	243.1	224.9
3	5859	4638	6505	15.9	15.3	6.70
5	2870	2077	2959	6.41	4.92	2.98

- Fractional power control compared with regular power control and full power transmission:
  - Fractional power control provides the best tradeoff between the spectral efficiency and cell-edge performance.

## **Conclusions**

- Fractional power control scheme can be applied for 802.16m
  UL interference coordination/control
- Inter-cell interference control through backhaul messaging
- Significant gains in term of simultaneous cell edge performance and sector throughput over regular and full power schemes.
- Tightly control of IoT is achievable through fractional power control

# Proposal to 802.16m SDD

- Include the following components in the SDD ToC
  - Uplink interference coordination and control