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**Title:** Node B Synchronization Link Analysis  
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## 1 Introduction

This paper evaluates the link margin for Node B Synchronisation for Macro Cells using the Sync Channel Approach. It shows that there is excess link margin between Macro Cells, using the propagation models of reference [1] and typical Sync Channel Power Levels.

## 2 Model Assumptions

- The propagation model, based on reference[1] is the COST 231, Hata model.
- The cell to cell distance was set at 2 km, consistent with reference [1]
- The Primary Sync Code (PSC) power was varied over the range 30 to 40 dBm. The total power of the three Secondary Sync Codes (SSC) is equal to the PSC power, so if the typical level for the PSCH channel is 9 dB below the total transmit power, the typical PSC power level is 31 dBm for a 43 dBm BS.
- The full set of parameters is summarized in the table below.

	<b>BS - BS</b>	<b>BS - UE</b>
Path Loss Model	COST-231 Hata	COST-231 Hata
Cell Type	Macro	Macro
Environment Type	Urban	Urban
City Size	Large	Large
Carrier Frequency (MHz)	2000	2000
Cell Radius (km)	1.15	1.15
BS-BS Distance (km)	2.00	2.00
Tx Antenna Height (m)	20	20
Rx Antenna Height (m)	5	1
Path Loss (dB)	-149.1	-146.8
Total Tx Power (dBm)	43.0	43.0
PSC Channel Ec/Ior (dB)	-6.4	-6.4
Tx EL Antenna Gain (dB)	6	6
Tx Loss (dB)	2	2
Log Normal Shadowing (dB)	8	8
Rx EL Antenna Gain (dB)	6	0
Rx Loss (dB)	2	0
<b>Calculated Rx Power (dBm)</b>	<b>-112.5</b>	<b>-114.2</b>

PSC Post-Processed S/N (dB)	9	9
Processing Gain (dB)	24.1	24.1
Nt(dBm)	-174	-174

NF (dB)	5	9
BW (MHz)	3.84	3.84
Cell Noise Rise (dB)	0	0
<b>Required Rx Power (dBm)</b>	<b>-118.2</b>	<b>-114.2</b>

<b>Link Margin (dB)</b>	<b>5.7</b>	<b>0.0</b>
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### 3 Link Margin Results

Figure 1 shows the Received post-despreading SNR for both the Cell to Cell and Cell to UE Links.

It is seen that the Cell to Cell case has 5.7 dB advantage over the Cell to UE case.

For Transmitted PSC power = 36.6 dBm, the UE has 0 dB Link Margin, while the Cell to Cell case has a positive, 5.7 dB margin.

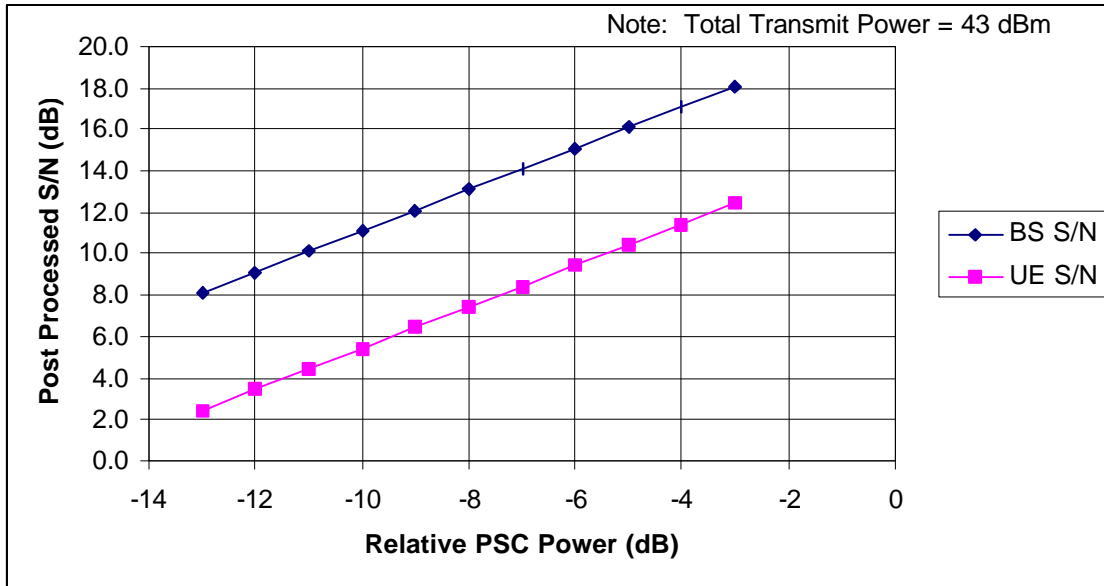


Figure 1: PCS Post-Processed S/N Level

### 4 Conclusion

For the Macro cell case, using the propagation assumptions of Reference [1], the Cell to Cell Link has greater margin than the Cell to UE case, for a UE at the cell edge.

This is true for the non-sectored cell; i.e. omnidirectional in azimuth. The Cell to Cell Link will be much stronger for sectored cells. BS-BS pathloss assumed to be similar to BS-UE, but height of BS will give it an advantage. UE has more difficult propagation environment – no fade margin assumed in calculation.

### 5 References

[1] R1-00-0074 “Node B Synchronisation for TDD”, Siemens, , Beijing, China, January 18 - 21, 2000.

