



Principios de las comunicaciones inalámbricas
Caso Práctico

Zona objetivo

Area: X Kms²




Requerimiento de Cobertura

Bucaramanga



Bucaramanga / Superficie

165 km²

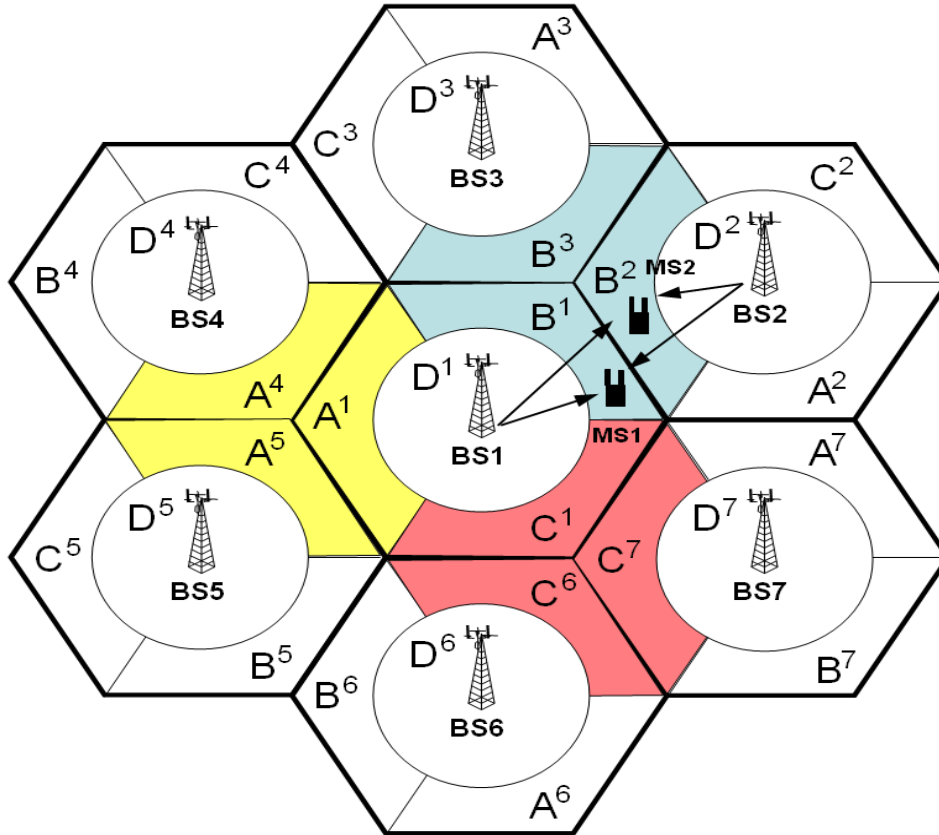


Comentarios

Cantidad de
sitios
requeridos ¿?



Determinar radio de cobertura



Area: 165 Kms²



Radio celda ?

- Frecuencia
- Potencia tx
- Sensibilidad receptor
- Nivel de ruido en el receptor
- Tipo de servicio
- Interferencias en la propagación

Cantidad de sitios requeridos ¿?



Link Budget UL



Link Budget

link budget

Comparing systems with the same data rate, carrier frequency, then we find that the maximum ranges of LTE and 3G systems are actually very similar.

	GSM voice	HSPA	LTE	Uplink	GSM voice	HSPA	LTE
Downlink				Data rate (kbps)	12.2	64	64
Data rate (kbps)	12.2	1024	1024	Transmitter – UE			
Transmitter – Node B				Max tx power (dBm)	33.0	23.0	23.0
Tx power (dBm)	44.5	46	46	Tx antenna gain (dBi)	0.0	0.0	0.0
Tx antenna gain (dBi)	18	18	18	Body loss (dB)	3.0	0.0	0.0
Cable loss (dB)	2	2	2	EIRP (dBm)	30.0	23.0	23.0
EIRP (dBm)	60.5	62	62	Receiver – Node B			
Receiver – UE				Node B noise figure (dB)	–	2.0	2.0
UE noise figure (dB)	–	7	7	Thermal noise (dB)	–119.7	–108.2	–118.4
Thermal noise (dB)	–119.7	–108.2	–104.5	Receiver noise (dBm)	–	–106.2	–116.4
Receiver noise floor (dBm)	–	–101.2	–97.5	SINR (dB)	–	–17.3	–7.0
SINR (dB)	–	–5.2	–9	Receiver sensitivity	–114.0	–123.4	–123.4
Receiver sensitivity (dBm)	–104	–106.4	–106.5	Interference margin (dB)	0.0	3.0	1.0
Interference margin (dB)	0	4	4	Cable loss (dB)	0.0	0.0	0.0
Control channel overhead (%)	0	20	20	Rx antenna gain (dBi)	18.0	18.0	18.0
Rx antenna gain (dBi)	0	0	0	Fast fade margin (dB)	0.0	1.8	0.0
Body loss (dB)	3	0	0	Soft handover gain (dB)	0.0	2.0	0.0
Maximum path loss	161.5	163.4	163.5	Maximum path loss	162.0	161.6	163.4



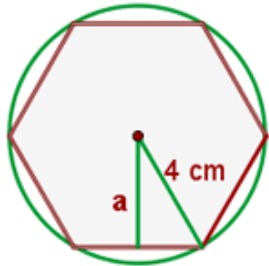
Área de un hexágono regular

Área de un hexágono regular

$$A = \frac{\text{perímetro} \cdot \text{apotema}}{2}$$

Ejemplos

Calcular la apotema, el perímetro y el área de un hexágono regular inscrito en una circunferencia de 4 cm de radio.



$$l = r = 4$$

$$a = \sqrt{4^2 - 2^2} = 3.46 \text{ cm}$$

$$P = 6 \cdot 4 = 24 \text{ cm}$$

$$A = \frac{24 \cdot 3.46}{2} = 41.52 \text{ cm}^2$$

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