DETAILED COVERAGE DIMENSIONING

Calculating No. of sites for urban area of 10 km^2 with coverage probability 90% in 2100Mhz with 10 Mhz carrier BW, Tower Height is 30m with a feeder of 7/8 inch with 2 jumpers each of 2m.

knowing that (eNB max. power) is 43 dBm and (Bs ant. Gain) of 18 dBi and (IM 'UL')= 2dB and (IM 'DL')= 3dB and required SINR is -3 dB for UL and -2 dB for DL with (UE max. power) of 23 dBm at T=290 Kilven (NF 'UE')= 7dB and (NF 'eNB')=9dB for only PRB used in UL and TMA with gain 5dB.

ANSWER:

MAPL (Max Allowable Path Losses):

$$MAPL = Txpwr - losses(feeder + connectors + jumpers) + Tx.ant.gain - losses\ margins + Rx.ant.gain - Rx.sens$$

$$Rx.sensitivity = handset + noise\ figure + thermal\ noise + SINR.Req$$

- $thermal\ noise = K * T * Bw$ **,(where k is boltzmann's constant and T is temperature).**
- SINR is a signal to interference and noise Ratio(SINR is -3 dB for UL and -2 dB for DL)
- (NF 'UE')= 7dB and (NF 'eNB')=9

For DL:

Bs (Tx . Power) = 43 dBm

And UE (Rx. Sens) = 10 log (290 * K * (50 * 180000 * 1000) + 7 +(-2)= -99.43 dBm

For UL:

UE (Tx . Power) = 23 dBm

And eNB (Rx. Sens) = 10 log (290 * K * 360.000 * 1000) + 9 +(-3) = -112.414 dBm

$$losses\ Margine = penetration|_{losses} + body|_{losses} + slow\ fading|_{losses} + IM|_{UL}$$

- Penetration losses is attenuation in signal level due to building and cars (for urban area =20)
- UE antenna gain = 0 dB
- Body loss = 0 dB
- Building loss = 20 dB
- Shadow fading margin = 1.8 dB
- Fast fading margin = 2 dB (due to urban area)
- IM 'UL' = 2dB
- IM 'DL' = 3dB

Cable losses:

Feeder length = Tower height +5m.
Jumper loss= 0.5 inch.feeder*num of jumpers *jumper length.
Connector losses=num of jumpers * 0.05dB.

Feeder type	Loss (dB/100m)		
	2600 MHz	2100 MHz	900 MHz
½ inch	11	10.8	9
7/8 inch	6.3	6	4.9
1.25 inch	4.6	4.5	3.2
1.625 inch	3.8	3.5	2.6

Calculation:
Feeder length= 30+5 = 35m
Feeder losses = (6/100) * 35 = 2.1 dB
Jumper losses = 2* [(10.8/100) * 2] = 0.432 dB
Connectors losses = 2 * 0.05 = 0.1 dB
Total losses = 2.1 + 0.432 + 0.1 = 2.632 dB

For DL

MAPL = 43-2.632 +18 1.8 20 2 3+ 99.43 = 130.998

For UL

MAPL = 23-2.632 +18 1.8 20 2 2+5+ 112.414 = 129.982

Multipath model (Hata model) Based on practical measurements. For F >1500 MH:

To get Radius(R):

$$L = 46.3 + 33.9log(f) - 13.82log(h_B) - a(h_R) + [44.9 - 6.55log(h_B)]log(d)$$

$$a(h_R) = [1.1log(f) - 0.7]h_R - [1.56log(f) - 0.8]$$

For DL

MAPL =130.998 , $f = 2100$, $(h_B) = 30$m , (h_M)=1.5m , So R= 0.614 Km

so area = 0.734756 Km2 , So we need 14 sites.

For UL

MAPL = 129.982 , $f = 2100$, $(h_B) = 30$m , (h_M)= 1.5m , So R= 0.5745 Km

so area = 0.6433 Km2 , So we need 16 sites

DETAILED CAPACITY DIMENSIONING

For FDD mode with 3 sector sites with 70 % load and carrier BW 10 MHz working with 64 QAM for all users With no MIMO and with short CP and CCH =5%;Where (coding rate for 64QAM =93%).

T cell	***= 2000*NRB* (No of resource element per block)* (modulation order*coding rate) *(1-CCH) = 2000*50 * (12*7- 4)*(6*0.93) * (1- 0.05)= 42.4Mbps***
T Site	***= 42.4 *3* 0.70 = 89.04Mbps***

For area with population of 180000 and mobile pentrationpentration125% and market share of 35% and busy hour active 125% and market share of 35% and busy hour active users of 50% with traffic as following:

- ❏ 25% voice call of 3.5 min. calls
- ❏ 45% browsing for 60 min. session
- ❏ 10% gaming of 60 min session
- ❏ 20% streaming for 30 min. session with BLER=1%

Busy hour active users	**= 180000 * 1.25 * 0.35 * 0.50 = 39375 active users**
Having session traffic from tableTotal traffic	**=[(0.25 * 39375 * 2715) + (0.45 * 39375 * 46544) + (0.10 * 39375 * 93091) + (0.20 * 39375 *518182)] /3600= 1471.85 Mbps**
No. of sites	**= 1471.85 / 89.04 = 16.53 ~ 17 ~ 17 sitesite**

Finally :

Take the max number of sites which is 17 sites.