## Okumura Model

This model is used for finding out Path Loss in the frequency range of 150MHz to 1920 MHz (typically extended up to 3 GHz) for distances of 1 to 100 Km & base station antenna heights ranging from 30m to 100 m. Approximations have taken from this model for transmitter antenna height of 3 m & distance below 1 Km.

Okumura model is wholly based on measured data.

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Path Loss = FPL + A(f,d) - G($h_{te}$) - G($h_{re}$) - G(Area)

Where :

FPL = Free Space Path Loss = 20 log {4*PI*d*f/c}

c = Speed of Light

d = distance

f = Frequency

G($h_{te}$) = 20log($h_{te}$ /200) 1000m > $h_{te}$ > 30 m

= 10 log ($h_{te}$ /200) $h_{te}$ < 30 m ( Approximation taken)

G($h_{re}$) = 10log($h_{re}$ / 3) $h_{re}$ < 3 m

= $20\log(h_{re} / 3)$ 10 m > $h_{re}$ > 3 m

G(Area) @ 2.4 GHz from the Curves

= 33 (Open Area)

= 27 (Quasi Open Area)

= 13 ( Suburban Area)

A(f,d) = Median Attenuation : function of frequency & distance

= 13 dB from curve @ 2.4 GHz & distance up to 1 Km.