## Cost- 231 Hata Model

The COST-231 Hata model extended Hata's model for use in the 1.5-2MHZ frequency range. This model is used in base station antenna is above the roof tops and is widely used in radio transmission in mobile telephony. [1]

---

**COST-231 Path Loss**

$$PL_{231}(dB) = 46.3 + 33.9 \log_{10}(f)$$
$$- 13.28 \log_{10}(h_{tr}) - a(h_{tt}) + 44.9 - 6.55 \log_{10}(h_{tr}) + \log_{10}(d) + Cc$$

*Cc =0, for medium city and suburban areas*
*Cc=3, for metropolitan areas*
*f: carrier frequency -> 1.5-2MHZ*
*$h_{tr}$: base station antenna height -> 30-200m*
*$h_{tt}$: mobile station antenna height -> 1-10m*
*d: transmission distance -> 1-20km*

$a(h_{tt}) = 3.2 \left(\log_{10}(11.75 h_{tt})\right)^2 - 4.97,$ for urban areas

$a(h_{tt}) = (1.1 \log_{10}(f) - 0.7)h_{tt} - (1.56 \log_{10}(f) - 0.8),$ for suburban and rural areas

---

References

[1]    Bengawan Alfaresi, Taufik Barlian, Feby Ardianto, and Muhammad Hurairah. 2020. Path Loss Propagation Evaluation and Modelling based ECC-Model in Lowland Area on 1800 MHz Frequency. *J. Robot. Control* 1, 5 (2020). DOI:https://doi.org/10.18196/jrc.1534