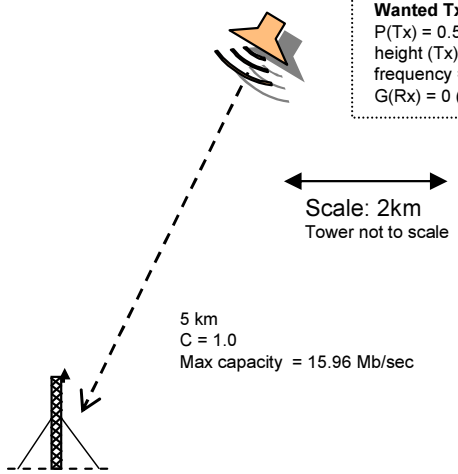
Interference – CIV-GND-UHF-INT-1 scenario 1a

Initial scenario with ‘wanted’ mobile Tx to base station Rx

Baseline obstruction version (flat terrain, no buildings high enough to obstruct LOS, no significant vegetation)
‘suburban’ noise level < receiver sensitivity S(Rx)

- The initial scenario shows a typical hand held mobile Tx of low power, transmitting to a base station on a 30m high tower, with an omni-directional antenna of reasonable gain (5dBi).
- The frequency used is 2.1 GHz, in a similar range to many mobile networks requiring high capacities and bandwidths than those available at VHF. In this case the bandwidth is 2 MHz.
- As with most mobile networks, the base station uses a high elevation and reasonably high gain antenna and low Rx sensitivity, to counter-balance the low height and Tx power of the mobile.
- The base station Rx sensitivity S(Rx) is higher than the ambient ‘suburban’ level noise floor and so the system is internally noise limited.
- At 5 km range, the mobile is near the edge of where it has perfect connectivity of 1.0 to the base station. The maximum theoretical channel capacity of 15.96 Mb/sec would be adequate for 3G HSUPA (High Speed Uplink Packet Access) but not enough for downlink on 3.5G HSPA+.
- If the noise floor were to rise above the level of the base station Rx sensitivity, then the connectivity and capacity of the link would fall.



- Connectivity (C) for a link is related to the signal to noise (SNR) at the Rx.
- This is related to the received signal strength from the Tx, the Rx sensitivity (S) and the external radio noise.
- For example a 10dB SNR results in C = 0.9, with connection 90% of the time and outage 10% of the time.
- The higher the SNR, the higher the connectivity.

Interference – CIV-GND-UHF-INT-1 scenario 1b

Introduce similar mobile Tx as interferers

- Considered here is the addition of three more similar mobile transmitters, at greater range from the base station than the wanted Tx. Not all are on the same frequency as the wanted link, but all have some overlapping bandwidth.
- The interfering Tx are not intentionally transmitting to the base station (the wavefronts indicate intended receiver direction) but as they are using omni-directional antennas they actually broadcast in all directions.
- The bandwidth of Tx1 is wider than the wanted Tx and therefore encompasses it, so there is complete overlap.
- The bandwidths of Tx2 and Tx3 only partially overlap the wanted transmission, so their transmitter power is diluted by a few dB of **'offset channel rejection'.**
- The combination of the existing noise floor with these three interferers in the wanted bandwidth gives a higher noise floor of -93dBm, which is above the base station Rx sensitivity and thus diminishes the SNR of the wanted signal.
- The connectivity of the wanted link is reduced to 0.9, and is therefore unavailable 10% of the time.
- The maximum capacity has fallen to 6.92 Mb/sec which is 43% of the previous, and now slightly too slow for 3G HSDPA (HighSpeed Downlink Packet Access) although more than adequate for UMTS.
- Even though the received signal at the base station, from each of the interfering Tx, is over 10dB below that of the wanted Tx, their addition is enough to raise the noise floor above the Rx sensitivity and degrade the link.