Railway/motorway radio network

Radio Activity Solutions

Abstract

Radio Activity Solutions

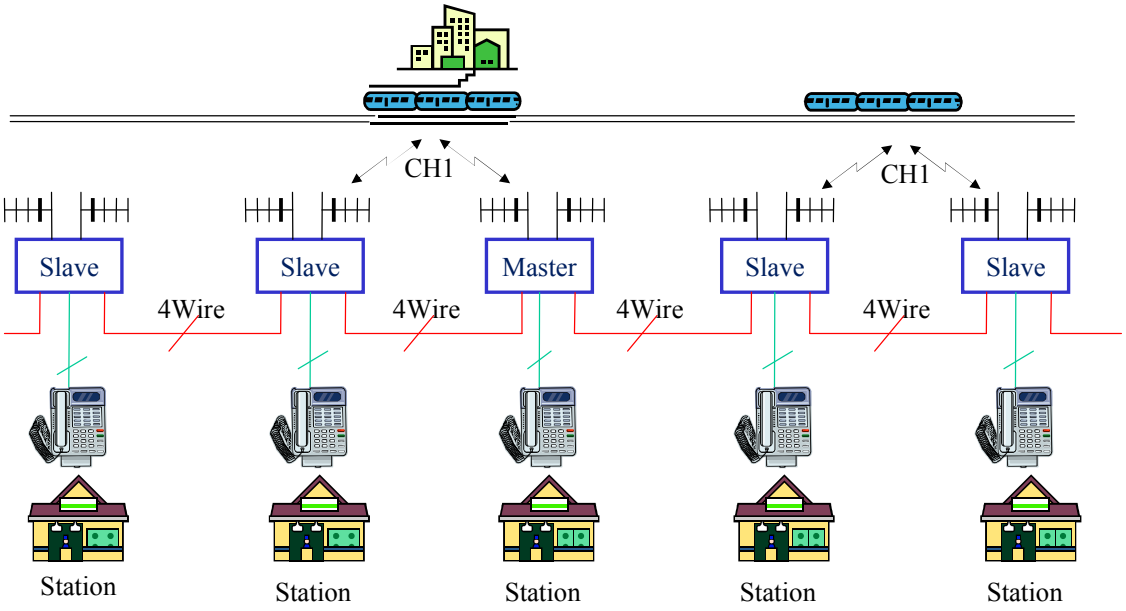
This presentation deals with the project of a **4-wire linked, pipeline linear type, simulcast radio network for railways / motorways** applications.

Here following, one radio channel network has been developed, but the structured can be simply extended to a multichannel network.

The presentation will focus on:

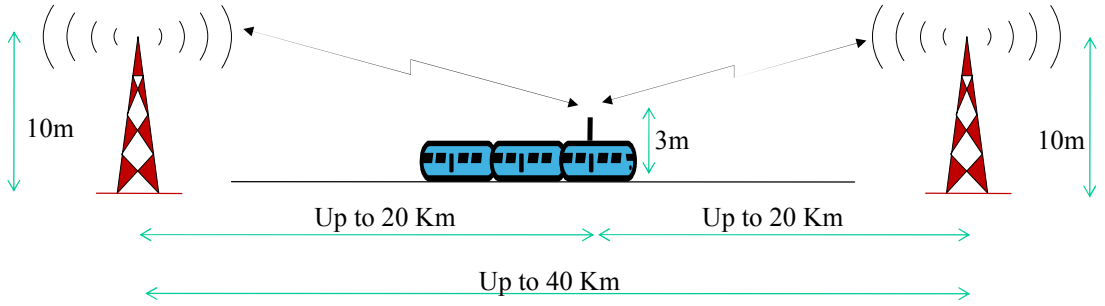
- results of **radio path calculations** and **copper line attenuation** simulations, in order to **predict network size**;
- an essential explanation of what **"simulcast" network means**;
- a brief analisys of issues related to **channel equalization and delay compensation** (down-link);
- a brief explanation of **voting system** (up-link) and **line loop closure** in case of faults;
- an example of **economic assessment** of the cost of a network.

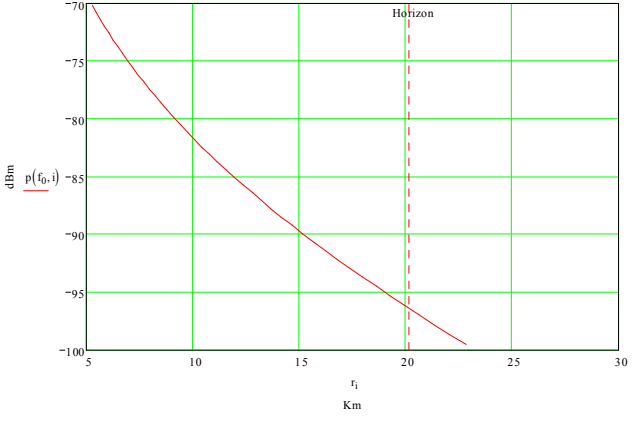
Network – audio connections (1 ch)



- The same RF channel over all Network => One communication per channel
- All stations directly connected to the network => Integrated communication sys
- Automatic roaming and hand-over => Easy to use
- Functioning like single “big repeater” => automatic and simple conference call operation

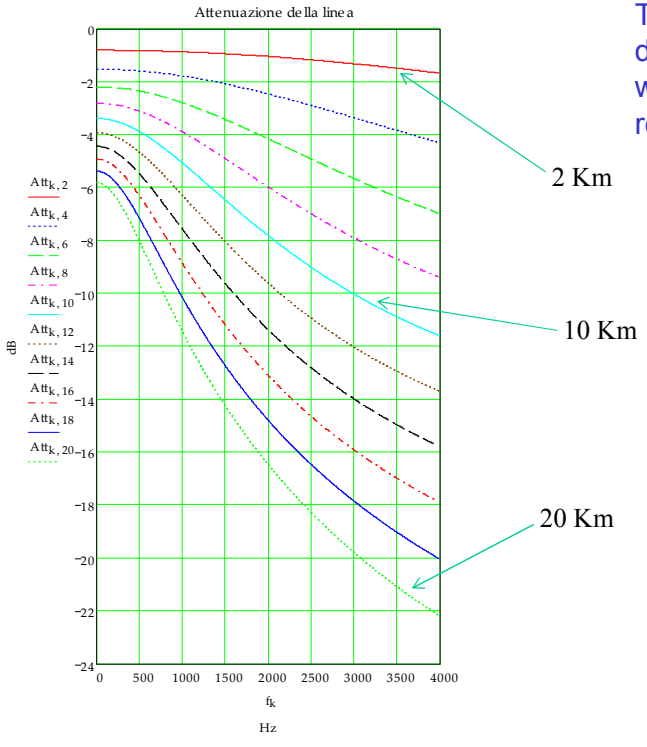
Network – radio propagation model





Antenna gain = 12dB
Base station antenna height = 10m
Mobile (train) antenna height = 3m
Frequency = 450MHz
RF Power = 10W / +40dBm
Horizont = 20.179 Km

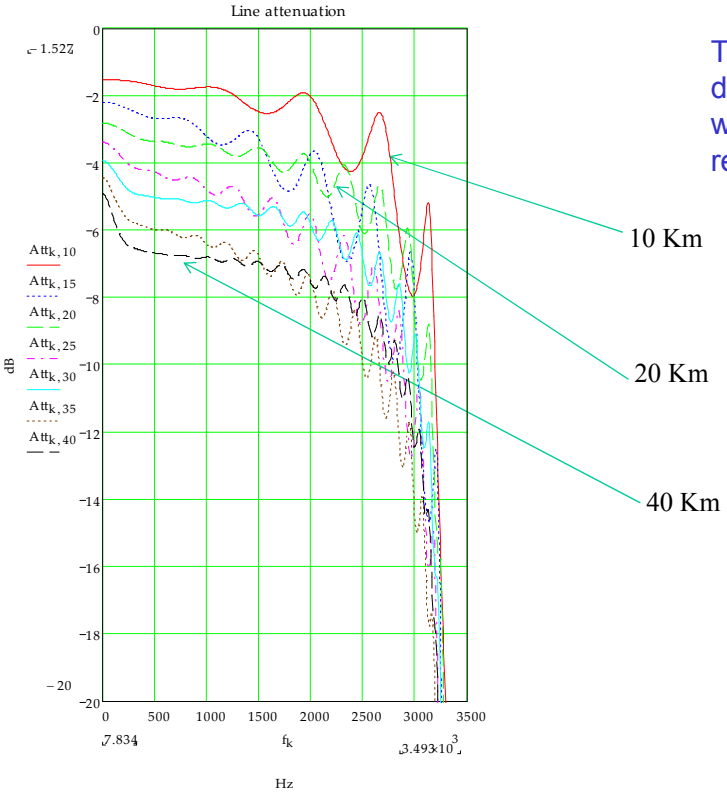
Copper lines – attenuation model



The reasonable maximum distance between base stations, without intermediate signals regeneration, is 20 Km

(non pupinized copper lines)

Punpinized copper lines – attenuation model

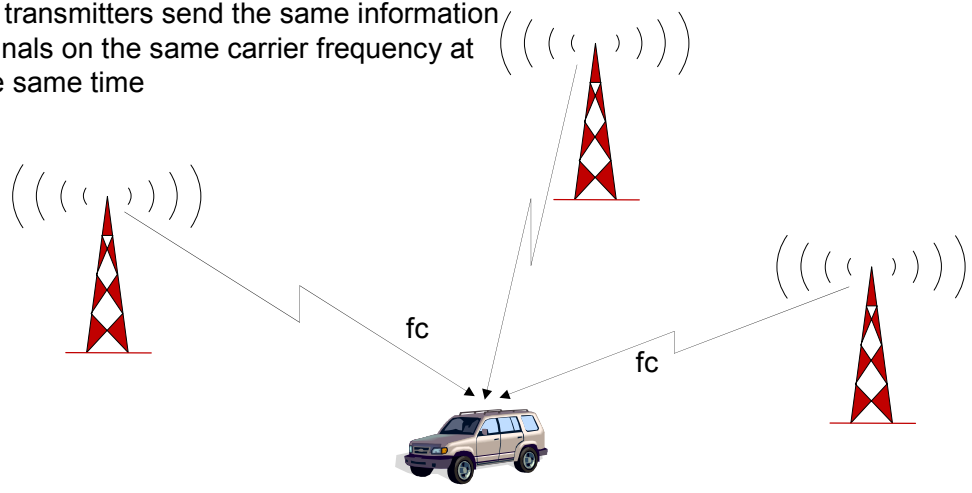


The reasonable maximum distance between base stations, without intermediate signals regeneration, is 40 Km

(pupinized copper lines)

Network – what does “simulcast” mean?

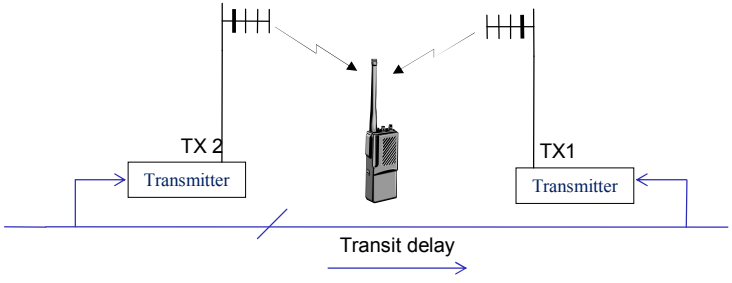
All transmitters send the same information signals on the same carrier frequency at the same time

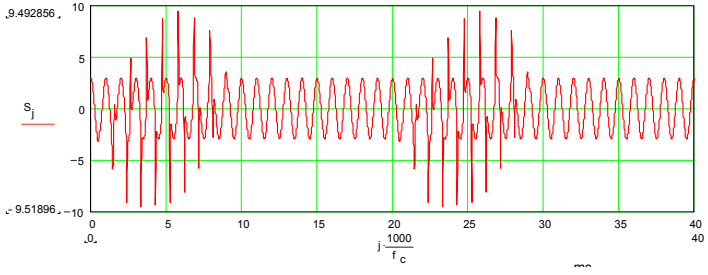


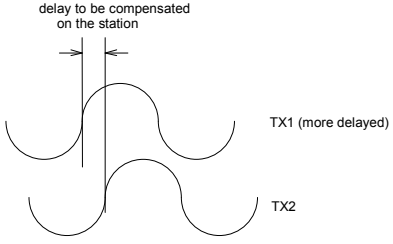
- The same RF channel over whole coverage area=> no channel change is needed through different repeaters, frequency saving
- Equivalent to a “big cell” single repeater => no special signalling like MPT1327 is required (fully transparent to conventional mobile equipments).
- Automatic roaming and hand-over => Easy to use, fast set-up call

Network – down-link equalization

If the transmitted signals are not accurately equalized in amplitude, phase and delay the mobile receiver will hear a very noisy signal

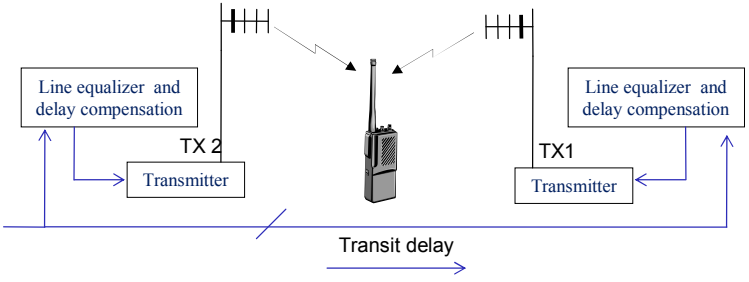


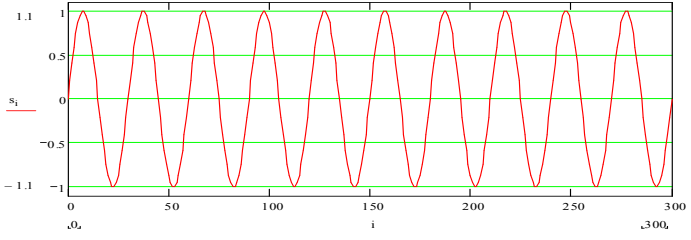


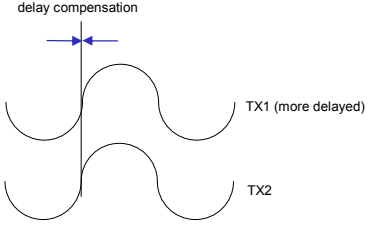


Network – down-link equalization

With the appropriate equalization and synchronisation the signals “sounds” very good

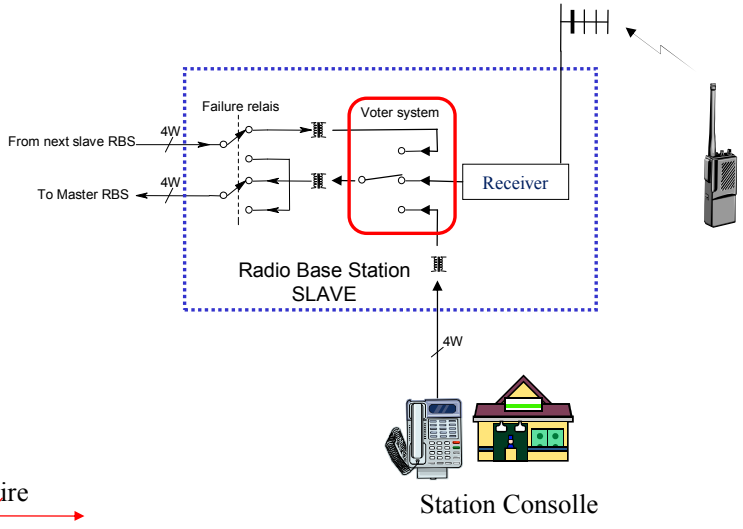


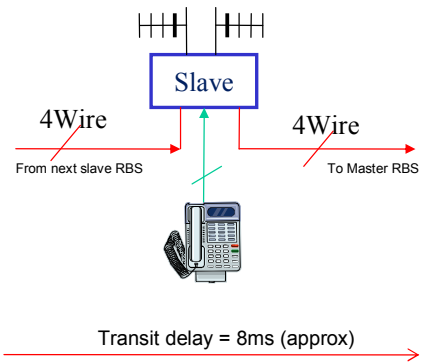




Network – up-link audio path (1 ch)

The real – time DSP voting selector chooses the best signal (greater S/N ratio) incoming to the network and sends it to the master station





The master station selects the best over-all signal incoming to the network and sends it to all base stations

Network – down-link audio path (1 ch)

The DSP line equalizer provides the necessary amplitude, phase and delay compensation. It extracts also the synchronism for the RF carrier. If needed, it can be connected to a GPS receiver.