

Radio Coverage for Digital PMR Networks

Efficient Radio Network Planning through optimised site configuration

The main objectives and challenges of radio network planning are obviously to achieve or exceed coverage and network quality specifications with minimal costs involved; and this is especially important when introducing a nationwide digital TETRA network.

Optimum result will only be achieved with meticulous planning adapted to each coverage condition and area, adjusting planning parameters according to each individual coverage task. Precise planning is the guarantee to not only achieve the expected quality and network coverage, but at the same time to ensure the most cost-effective network design as well as the most profitable network operation.

The following case study illustrates how an optimised transmitter configuration can increase the quality of service while keeping the same number of sites.

Coverage category	% of coverage for the whole area
Deep Indoor	62,9 %
Indoor / Terminal at Waist-Height	88,9 %
Indoor / Terminal at Head-Height	98,7 %

Table 1: Coverage categories of Reference Network - Standard configuration

Table 1 consists of different coverage categories for a typical TETRA network together with the actual coverage per category for the complete area under study (in percentage), taking into consideration a standard configuration (Omni-antenna with 7,5 dBi gain) for all sites.

Through detailed planning and the optimisation of the configuration of each single site, it was possible to increase coverage quality considerably for the area under study – while keeping the same number and the same position of sites. The new extended network coverage is shown in table 2:

Coverage category	% of coverage for the whole area
Deep Indoor	90,1 %
Indoor / Terminal at Waist-Height	98,7 %
Indoor / Terminal at Head-Height	99,8 %

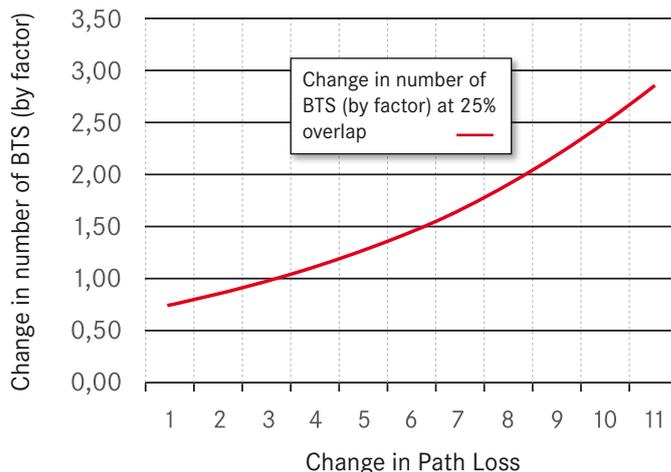
Tabelle 2: Coverage categories - optimised configuration

For the coverage category 'Indoor / Terminal at Waist-Height' coverage was increased by 9,8% and for the coverage category 'Deep Indoor', which is in particular difficult to realise, coverage was even increased by 27,2%.

In terms of technology this is facilitated by an optimised site configuration, for which the maximal path loss of a base station to be bridged was improved in average by 6dB. This led on the one hand to a greater reach and on the other hand to an enhanced coverage quality within the cell area (increase of the average signal level by 6dB)

If, otherwise, the same network performance and coverage quality was to be realised by a standard site configuration, one would have to increase the number of sites by 1,6 (see diagram 1).

The cost for the realisation of a site with an optimised antenna configuration is only about 23% higher than for a site with the standard configuration; but only 60% of the number of sites will be needed in this case.



Picture 1: Correlation between the change in path loss in dB and the increase of the number of base stations

Therefore it can also be estimated, that by applying an optimised site configuration, while keeping the initial network coverage quality, a potential of approximately 26% of investment expenditure can be saved as well as 20% of operational expenditure over a ten years operating time.

Efficient radio coverage planning with an optimal configuration of each individual transmitter is therefore the basis of any cost-effective digital PMR network design and operation. It guarantees simultaneously that network quality and coverage are maximised.

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