TSG-RAN meeting #17 RP-020641
Biarritz, France, 3rd – 6th September 2002

Source: **Qualcomm**

Title: **Layer 3 filtering considerations**

Agenda item: **7.2.2**

Document for: **Discussion and decision**

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1 Introduction

During last RAN2 meeting in Stockholm it was noted that different companies had different interpretations on the units to be used for Layer 3 filtering. This document presents some simulation results that should help the RAN Plenary meeting to decide on the way forward.

2 Statement of the problem

Layer 3 measurements are specified in TS 25.331, section 8.6.7.2, and in TS 25.302 section 9.1. They are in addition to the Layer 1 measurements specified in Physical Layer specifications. To summarize:

- L3 filtering: IIR with recursive definition, $F_n = (1-a)*F_{n-1} + a*M_n$, with:
  F_{n-1} previous filter output,
  M_n next measurement result,
  a=1/2^(k/2) L3 filter coefficient,
  k=0…19 parameter configured by network
- Two possibilities:
  1) Calculate L3 filter outputs in linear domain (e.g. in mW)
  2) Calculate L3 filter outputs in logarithmic domain (e.g. in dBm)

We understand that the computation in linear domain should be the correct method from a theoretical point of view. It should be studied how much the measurement after Layer 3 filtering would be different in case the computation was performed in the logarithmic domain. This is aim of the following section.

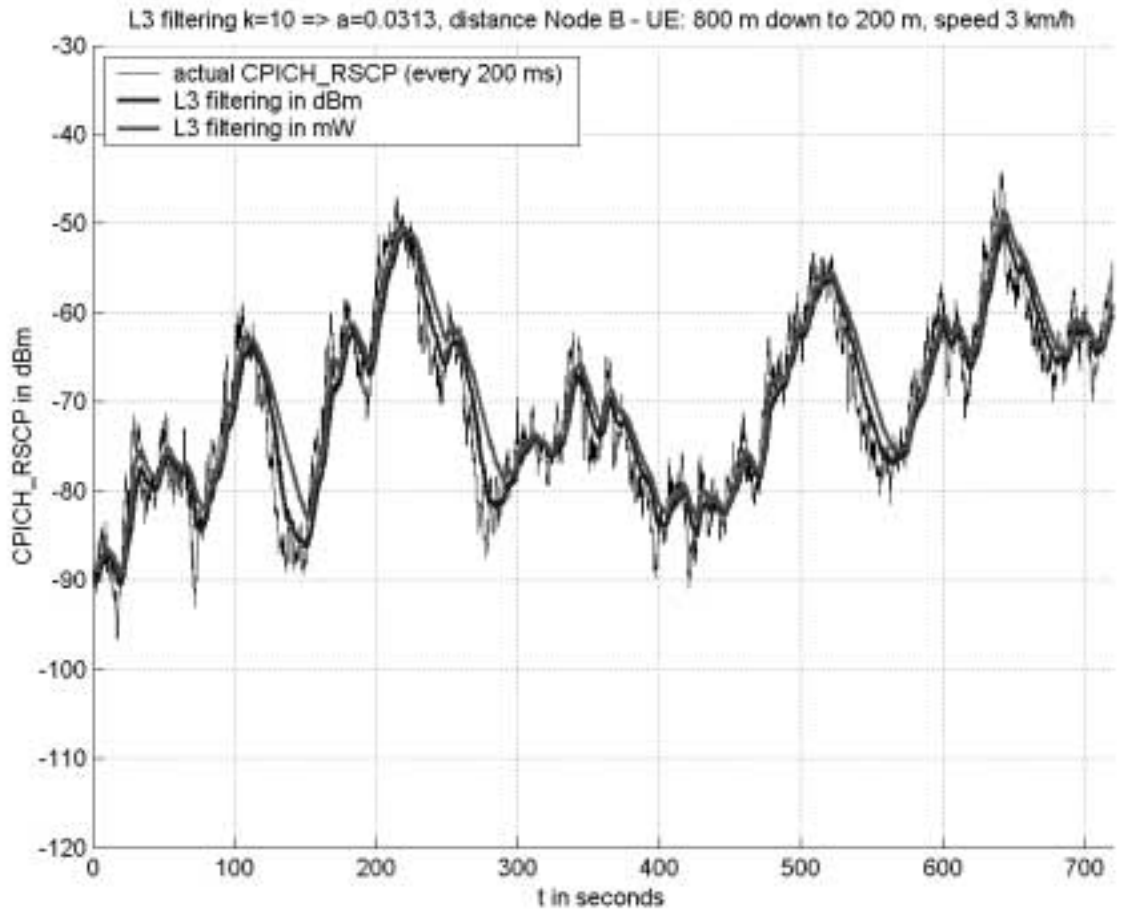
3 Simulations

Assumptions:

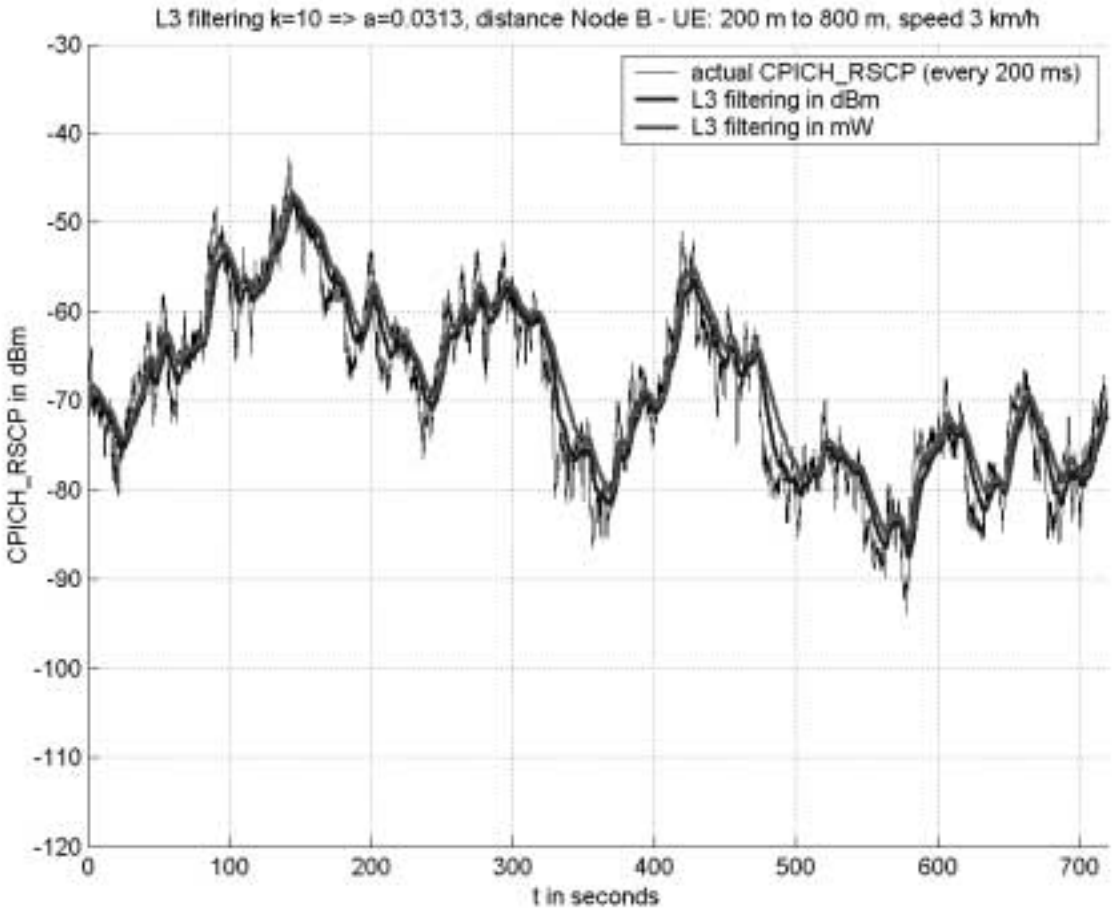
- Scenario: UE driving away from or towards a Node B. Distance between 200 m and 800 m
- UE speeds of 3 Km/h, 30 Km/h and 60 Km/h.
- Slow fading according to macro cell pathloss model in TS25.942
  [PL=128.1 dB + 37.6 log(R/km) + lognormal_fading]
- Correlation of slow fading over distance according to model in UMTS 30.03
  (Correlation-0.5 distance 20 m, exponential correlation function)
- Node B Tx power: +43 dBm
- Antenna gains: Node B 11 dBi, UE 0 dBi
- Minimum coupling loss: 70 dB
- CPICH transmit Ec/Ior: -10 dB
- Computation of actual CPICH_RSCP in dBm for 200ms measurement period, L1 reporting rate: 1 measurement per 200 ms.
- Computation of output of L3 filter for CPICH_RSCP in linear (mW) and logarithmic (dBm) domain
- Recording of error-factor (CPICH_RSCP_log/CPICH_RSCP_lin) for many runs at different speeds and for different filtering coefficients.
- Computation of CDF of error-factor for 3 km/h and 30 km/h environments and different filtering coefficients

Examples for CPICH_RSCP (perfect measurements @ rate of 1/200 ms)

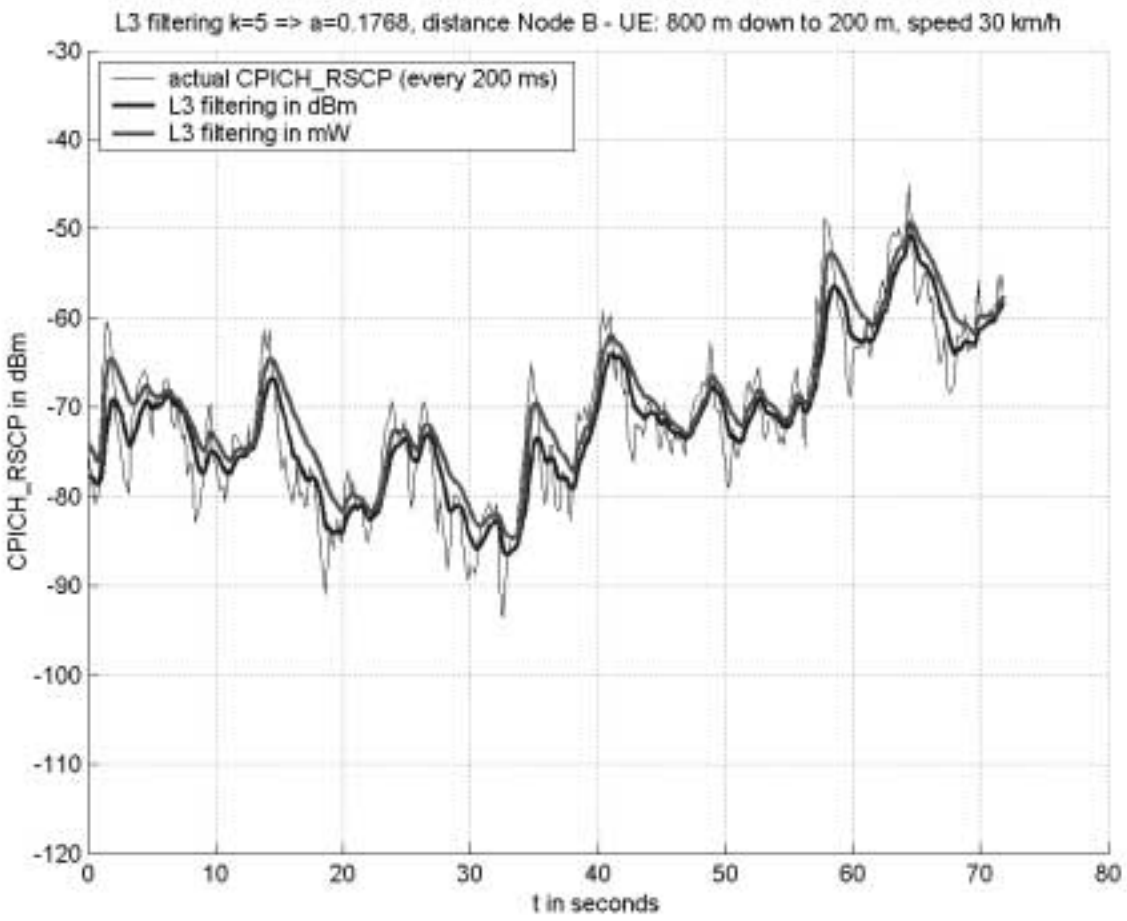
Exemplary run from 800m distance down to 200m distance at 3 km/h (720 seconds):



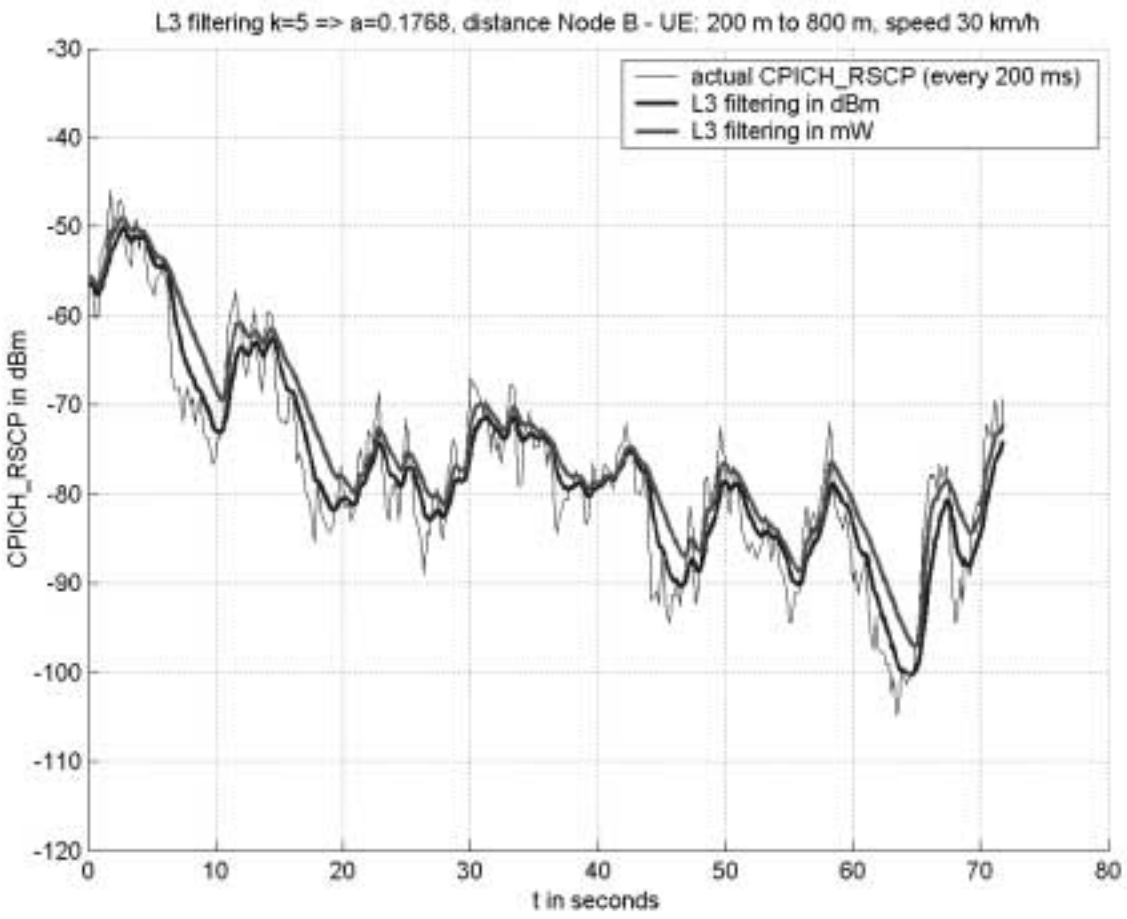
Exemplary run from 200m distance up to 800m distance at 3 km/h (720 seconds):



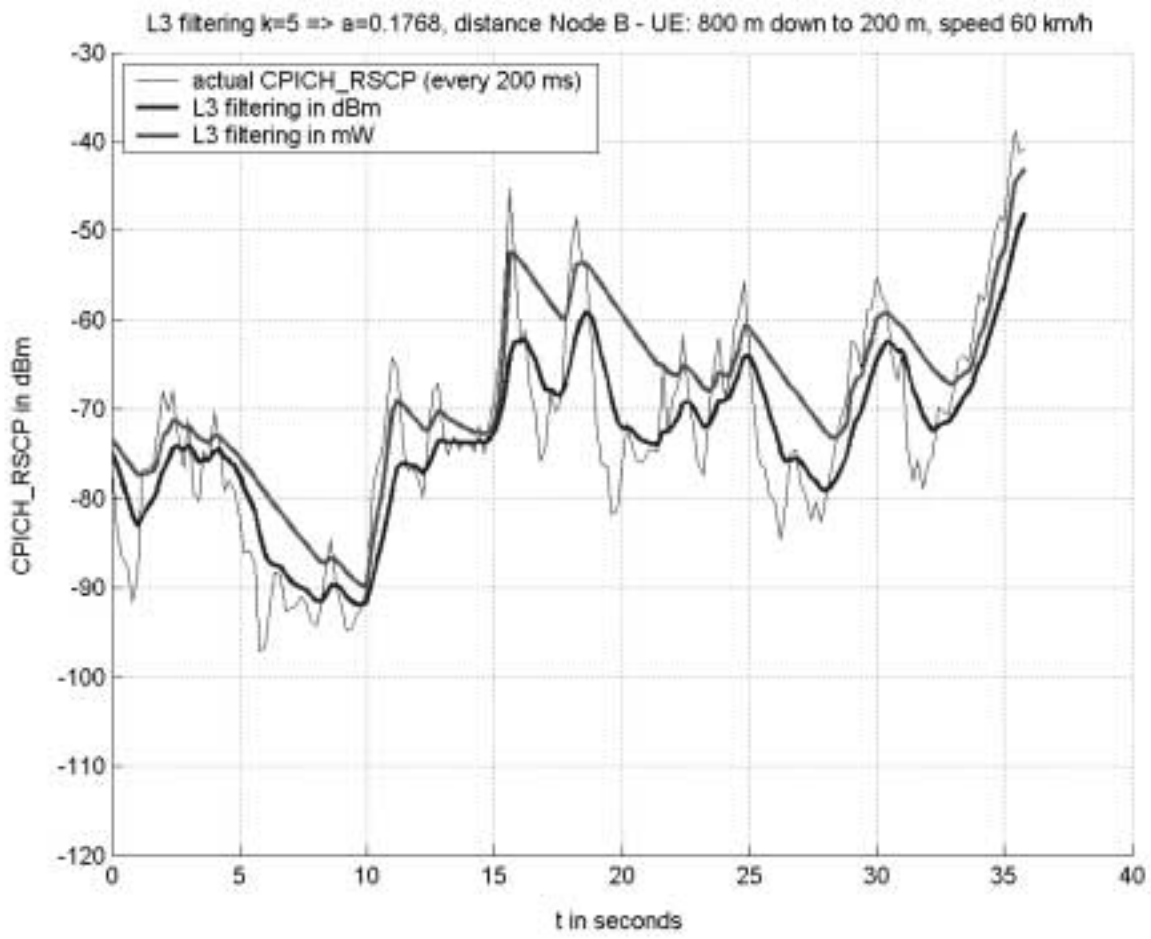
Exemplary run from 800m distance down to 200m distance at 30 km/h (72 seconds):



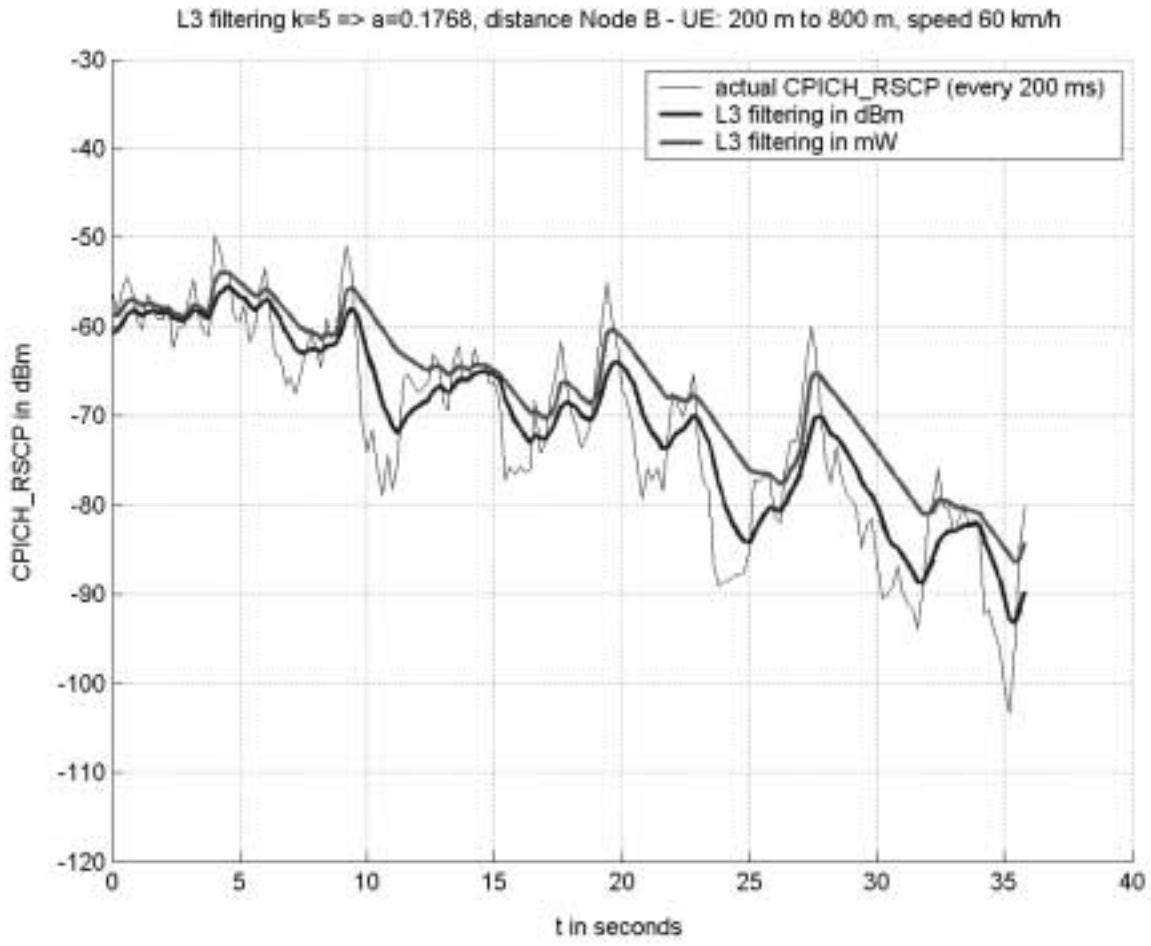
Exemplary run from 200m distance up to 800m distance at 30 km/h (72 seconds):



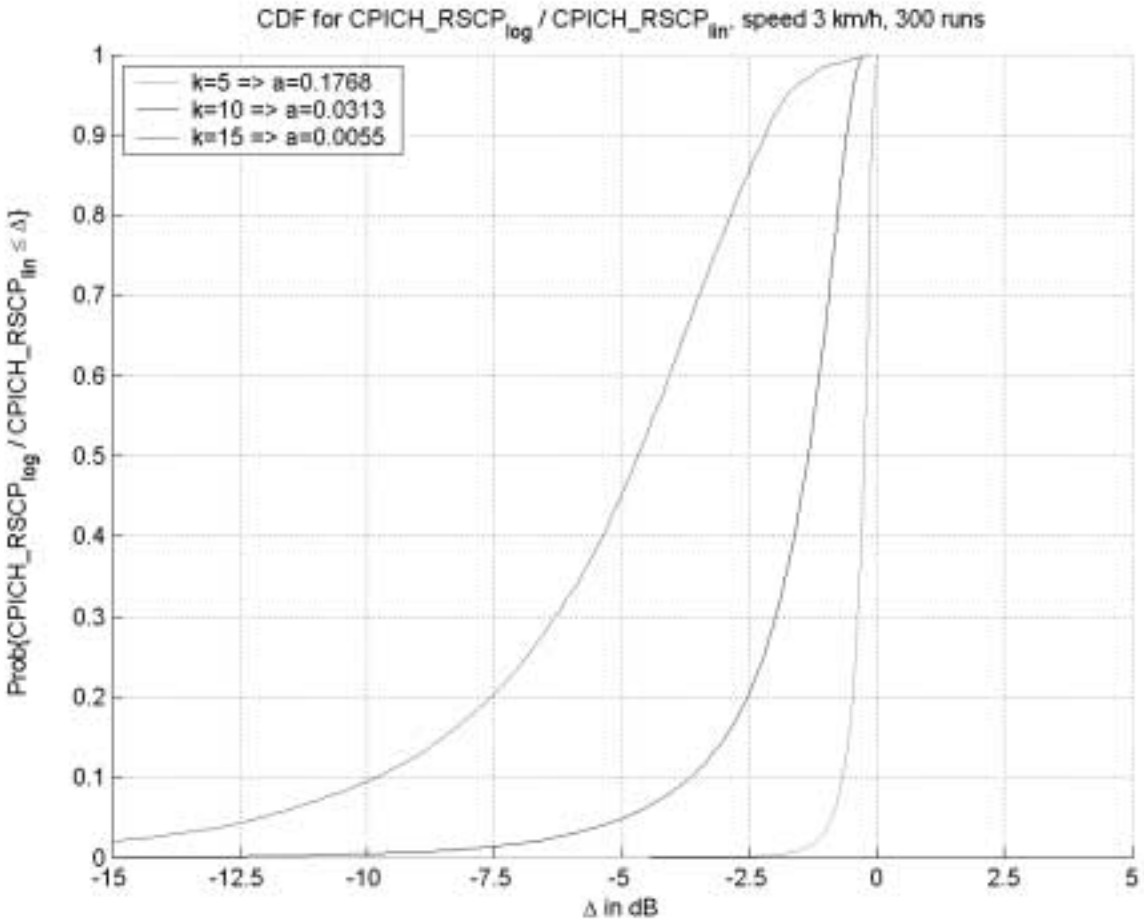
Exemplary run from 800m distance down to 200m distance at 60 km/h (36 seconds):

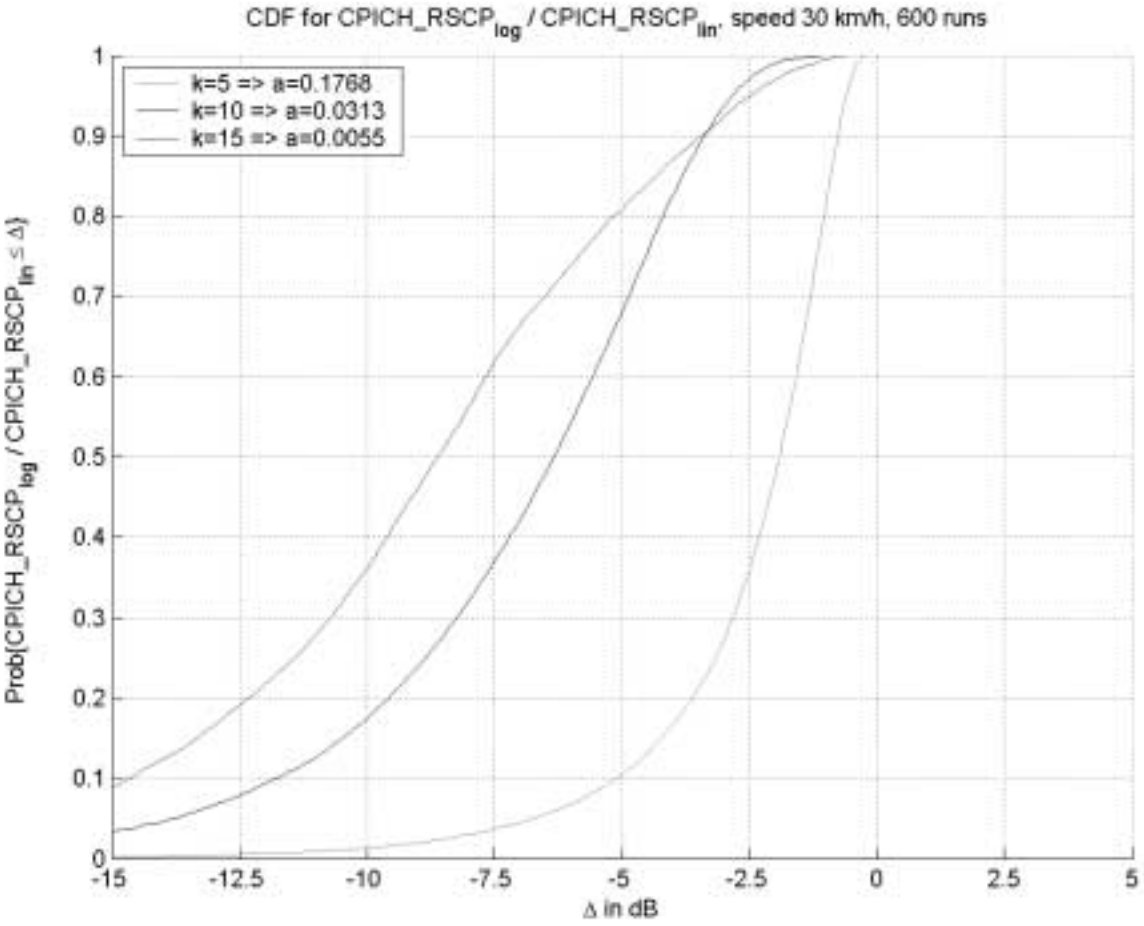


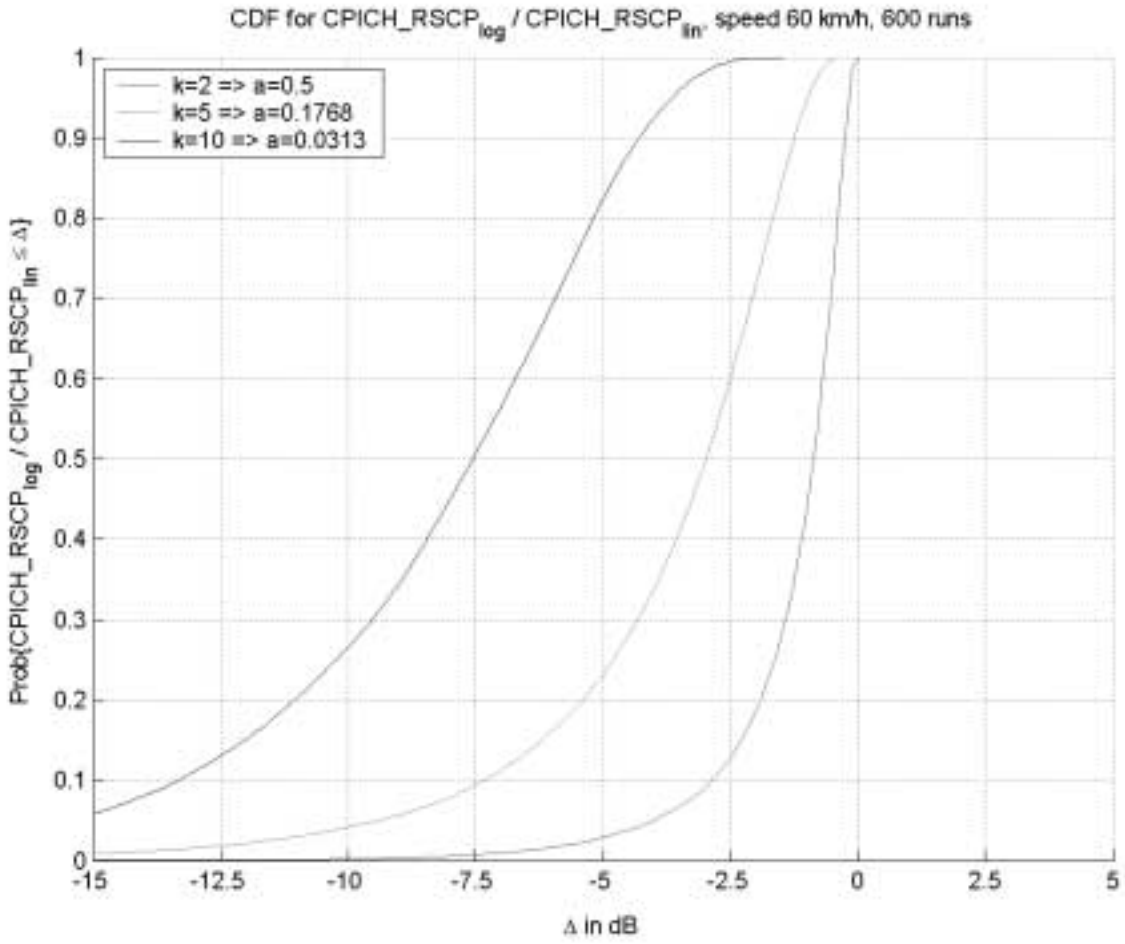
Exemplary run from 200m distance up to 800m distance at 60 km/h (36 seconds):



CDFs for CPICH_RSCP error-factor over many runs:




CDF for CPICH_RSCP$_{log}$ / CPICH_RSCP$_{lin}$, speed 30 km/h, 600 runs
k=5 => a=0.1768
k=10 => a=0.0313
k=15 => a=0.0055
Prob{CPICH_RSCP$_{log}$ / CPICH_RSCP$_{lin}$ ≤ Δ}
Δ in dB
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-15
-12.5
-10
-7.5
-5
-2.5
0
2.5
5



4 Conclusion

L3 filtering in logarithmic domain can result in quite large differences to the ideal value when the L3 filter coefficient gets small enough (k values > 2-5 depending on speed). The issue is not very critical for very large L3 filter coefficients (k in the range of 0…2). It is recommended to use the linear domain for L3 filtering and to approve CR 1517r1.