TSG RAN Meeting #14 **RP-010788**
Kyoto, Japan, 11 - 14 December 2001

Title: **CRs (Rel-4) to TR 25.943**

Source: **TSG RAN WG4**

Agenda Item: **8.4.4**

RAN4 Tdoc	Spec	CR	Title	Cat	Phase	Curr Ver	New Ver
R4-011580	25.943	1	CR to TR25.943 for changes to deployment model	F	Rel-4	4.0.0	4.1.0

3GPP TSG RAN WG4 Meeting #20 **R4-011580**

East Brunswick, NJ, USA 12th - 16th November 2001

CR-Form-v4

CHANGE REQUEST

⌘ **25.943**	**CR** **1**	⌘	ev **-**	⌘	Current version: **4.0.0**	⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [X] Core Network [ ]

Title:	⌘	CR to TR25.943 for changes to deployment model
Source:	⌘	RAN WG4
Work item code:	⌘	TEI4
Date:	⌘	2001-11-12
Category:	⌘	**F**
Release:	⌘	Rel-4

Use one of the following categories:
- ***F*** *(correction)*
- ***A*** *(corresponds to a correction in an earlier release)*
- ***B*** *(addition of feature),*
- ***C*** *(functional modification of feature)*
- ***D*** *(editorial modification)*

Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
- *2 (GSM Phase 2)*
- *R96 (Release 1996)*
- *R97 (Release 1997)*
- *R98 (Release 1998)*
- *R99 (Release 1999)*
- *REL-4 (Release 4)*
- *REL-5 (Release 5)*

Reason for change:	⌘	The deployment models are written in a generic way with arbitrary tap delays
Summary of change:	⌘	The simplification scheme allowing rounding off the models to 50 ns is removed. A new description for a generic way of simplifying the models is introduced in a new Annex.
Consequences if not approved:	⌘	The use of the models in applications with different delay resolution requirements will be ambiguous.

Clauses affected:	⌘	5, Annex X
Other specs affected:	⌘	[ ] Other core specifications ⌘ [ ] Test specifications [ ] O&M Specifications
Other comments:	⌘	

5 Channel model descriptions

Radio wave propagation in the mobile environment can be described by multiple paths which arise due to reflection and scattering in the mobile environment. Approximating these paths as a finite number of N distinct paths, the impulse response for the radio channel may be written as:

$$h(\tau) = \sum_{i}^{N} a_i \delta(\tau_i)$$

which is the well known tapped-delay line model. Due to scattering of each wave in the vicinity of a moving mobile, each path a_i will be the superposition of a large number of scattered waves with approximately the same delay. This superposition gives rise to time-varying fading of the path amplitudes a_i, a fading which is well described by Rayleigh distributed amplitudes varying according to a classical Doppler spectrum:

$$S(f) \propto 1/(1-(f/f_D)^2)^{0.5}$$

where $f_D = v/\lambda$ is the maximum Doppler shift, a function of the mobile speed v and the wavelength λ. In some cases a strong direct wave or specular reflection exists which gives rise to a non-fading path, then the Doppler spectrum is:

$$S(f) = \delta(f_s)$$

where f_s is the Doppler frequency of the direct path, given by its direction relative to the mobile direction of movement.

The channel models presented here will be described by a number of paths, having average powers $|a_i|^2$ and relative delays τ_i, along with their Doppler spectrum which is either classical or a direct path. The models are named TUx, RAx and HTx, where x is the mobile speed in km/h. Default mobile speeds for the models are according to Table 5.1. The relative position of the taps is for each model listed with a 0.001 µs resolution. ~~When the models are implemented, the relative time may be rounded off to the closest integer multiple of 0.05 µs.~~

Table 5.1: Default mobile speeds for the channel models.

Channel model	Mobile speed
TUx	3 km/h
	50 km/h
	120 km/h
RAx	120 km/h
	250 km/h
HTx	120 km/h

The models may in certain cases be simplified to a specific application to allow for less complex simulations and testing. The simplification should be done with a specific time resolution ΔT, which should be stated to avoid confusion: e.g. RAx(ΔT=0.1µs). An example of such a simplified model is shown in Annex X.

Annex X:
Example of simplified model using other time resolution

The models can be simplified to a specific application to allow for more efficient and less complex simulations and testing. The simplification should be done with a specific time resolution ΔT, which should be stated to avoid confusion: e.g. RAx(ΔT=0.1μs). The simplified application specific model is obtained by sampling the channel profiles in Tables 5.2, 5.3 and 5.4 at delays {0, ΔT , 2ΔT , 3ΔT, ... } as described in the example below. Only taps where the power is within 25 dB of the strongest tap need to be retained. Tap powers should be normalized so that the sum of all tap powers is equal to 1. All taps should have a classical Doppler spectrum, with the exception of the first tap in the simplified RAx channel which will be a superposition of a classical and a direct path Doppler spectrum (resulting in Ricean fading).

For a CDMA type system like UTRA, a typical ΔT used in simulations considered here may be ¼, ½ or 1 chip time.

For a Frequency Hopping or multicarrier system the ΔT should be set to consider the total system bandwidth to take the frequency correlation of the channel model into account.

An example of a simplified model is shown in Table X for UTRA FDD. In the example, ΔT is ½ of the chip time of UTRA FDD.

Table X: Example of a UTRA FDD channel model for rural area, RAx(ΔT=130.2 ns)

Tap number	Relative time (ns)	Average relative power (dB)	doppler spectrum
1	0	-2.748 composed of: -6.4 (Class) -5.2 (Direct path)	Class + Direct path, $f_s = 0.7 \cdot f_D$
2	130.2	-4.413	Class
3	260.4	-11.052	Class
4	390.6	-18.500	Class
5	520.8	-18.276	Class

The simplified channel model is sampled from the channel models listed in tables 5.2, 5.3 and 5.4. This sampling is accomplished by rounding the taps into the sample bins based on the value of ΔT. All taps from (i-1/2)ΔT to and including (i+1/2)ΔT would be sampled into the tap positioned at delay iΔT for all non-negative integers i.

For additional clarification, the computation of Table X is demonstrated in the worksheet in Table Y.

Table Y: Detailed worksheet to compute the simplified channel model in Table X

Tap number (from Table X)	Tap Relative time (from Table X in ns)	Relative time sampling range (from above sampling formula in ns)	Tap numbers from Table 5.3 sampled into this delay bin	Tap powers from Table 5.3 sampled into this delay bin (dB)	Total average relative power sampled into this delay bin (dB)
1	0.0	0.0 to 65.1	1, 2	-5.2 (direct path), -6.4 (Class)	-2.748 (-5.2 Direct path, -6.4 Class)
2	130.2	65.1 to 195.3	3, 4, 5	-8.4, -9.3, -10.0 (all Class)	-4.413
3	260.4	195.3 to 325.5	6, 7	-13.1, -15.3 (all Class)	-11.052
4	390.6	325.5 to 455.7	8	-18.5 (Class)	-18.500
5	520.8	455.7 to 585.9	9, 10	-20.4, -22.4 (all Class)	-18.276