TSG RAN Meeting #21 **RP-030424**
Frankfurt, Germany, 16 - 19 September 2003

Title CRs (Rel-6) to TS 25.951under WI "FDD BS Classification"
Source TSG RAN WG4
Agenda Item 8.9

RAN4 Tdoc	Spec	CR	R	Cat	Rel	Curr Ver	Title	Work Item
R4-020820	25.951	002	1	B	Rel-6	6.1.0	Localised interference in an operator's own network	RInImp-BSClass-FDD

3GPP TSG RAN WG4 (Radio) Meeting #28 R4-030820

Sophia Antipolis, France 18 - 22 August 2003

CR-Form-v7

CHANGE REQUEST

⌘ 25.951	CR 002	⌘ rev	1	⌘	Current version:	6.1.0 ⌘

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

Proposed change affects: UICC apps⌘ [ ] ME [ ] Radio Access Network [X] Core Network [ ]

Title: ⌘	Localized interference in an operator's own network			
Source: ⌘	RAN WG4			
Work item code: ⌘	RInImp-BSClass-FDD		***Date:*** ⌘	08/09/2003
Category: ⌘	**B**		***Release:*** ⌘	Rel-6
	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)* *Rel-6 (Release 6)*

Reason for change: ⌘	During RAN WG4#27 meeting in Paris it was requested to mention in TR 25.951 the possible localised capacity / coverage problems that can occur when a UE is close to its Local Area or Medium Range BS. Depending on the current UE minimum requirements, there exists a range of coupling loss above the MCL for which substancial degradations of network performance can be expected. This could result in a limitation of the coupling loss operating range that is to say a practical MCL higher than the MCL for which the classes of BS have already been designed. This CR aims then at highlighting the possible localised interferences in an operator's own network and giving guidelines for network planning.
Summary of change: ⌘	Current Annex B is divided into two paragraphs renamed B.1 for adjacent frequency localised interference and B.2 for intra-frequency localised interference. B.2 points out, through an example, the cases when this intra-frequency localised interference may occur and gives deployment recommendations to handle this problem.
Consequences if not approved: ⌘	. Inherent MCL limitations incurred along the existing UE requirements are not documented for Local Area and medium Range BS.

Clauses affected: ⌘	Annex B			
	Y	**N**		
Other specs affected: ⌘		**X**	Other core specifications	⌘
		X	Test specifications	
		X	O&M Specifications	

Other comments: **⌘**	

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

Annex B (informative): Radio Network Planning Considerations

B.1 Adjacent frequency Interference

B.1.1 General

The RF specification for Base Stations is to a large extent based on statistical averaging of interference effects. This should normally be sufficient to eliminate significant interference effects on adjacent frequency networks, if some simple rules (e.g. 30 dB MCL between Wide Area BS) are followed.

Especially in the case of Local Area and Medium Range BS, also considering some of their likely deployment environments (indoor, street canyons) there is however a higher probability that the interference on adjacent frequencies is localised. In these cases some co-ordination between operators may be required.

This informative Annex considers Radio Network Planning (RNP) measures, which can be applied in case there is significant interference between adjacent radio networks of different hierarchy level, e.g. between a MR and a WA network. In the following mainly aspects related to DL adjacent channel interference will be considered.

B.1.2 Example analysis for localized interference

Based on a number of assumptions on deployment of networks, the relevant parameter for the impact of DL adjacent channel interference caused by a MR or LA Node B is the maximum output power. From the Monte-Carlo simulation results contained in Annex A it can be seen that the DL capacity loss for an adjacent macro layer is upper-bounded by approximately no more than 6 % for a 38 dBm MR network layer. Similarly, it was shown that the DL capacity impact from a 24 dBm LA network on an adjacent MR network is of similar order.

While the average impact is thus small, there is nevertheless a chance that a macro layer UE gets localised interference by a MR or LA Node B under low coupling loss (CL) and weak serving signal conditions. This will be illustrated by the following example analysis for the case of a LA (indoor) cell interfering to an adjacent macro cell.

The following parameters will be assumed:

Table B.1: Assumed parameters for the localized interference analysis

Parameter	Value	Unit	Notes
UE ACS	33	dB	from 25.101
interfering LA BS maximum Tx power	24	dBm	from this TR
interfering LA BS antenna gain	0	dBi	from this TR
serving cell received DTCH level	-90	dBm	
bit rate	12.2	kbps	
Eb/Io	7	dB	

With these service parameters we obtain for the required Ec/Io:

Required Ec/Io = -25 dB [processing gain] + 7 dB [Eb/Io] = -18 dB

The area of the localized interference around the LA BS can be estimated as follows (In this calculation the own system (cell) interference is not taken into account, i.e. it is assumed that ACI dominates):

1) Maximum tolerated interference level on the own channel: -90 dBm + 18 dB [Required Ec/Io] = -72 dBm

2) Maximum tolerated interference level on the adjacent channel: -72 dBm + 33 dB [UE ACS] = -39 dBm

3) Required coupling loss CL towards interfering LA BS: +24 dBm – (-39 dBm) = 63 dB

4) Assuming the indoor path loss model from this TR for the case that internal walls are not modelled individually and a single floor, the indoor path loss model is represented by the following formula:

$$PL = 37 + 30\ Log10(R),$$

with R the UE – LA BS separation given in metres. From this, the required minimum distance towards the interfering LA BS is given by:

$$R = 10\text{^}(\ (63\ dB\ [CL] + 0\ dBi\ [LA\ BS\ antenna\ gain] – 37) / 30\ ) = 7.36\ m$$

As can be seen, the required minimum distance towards the interfering LA BS depends not only on the parameters of the interfering system (i.e. TX power, antenna gain), but also on the available DTCH signal level of the serving macro cell.

The following figure shows the size of the localized interference around the LA BS for serving cell received DTCH levels in the range of –70 … -110 dBm:

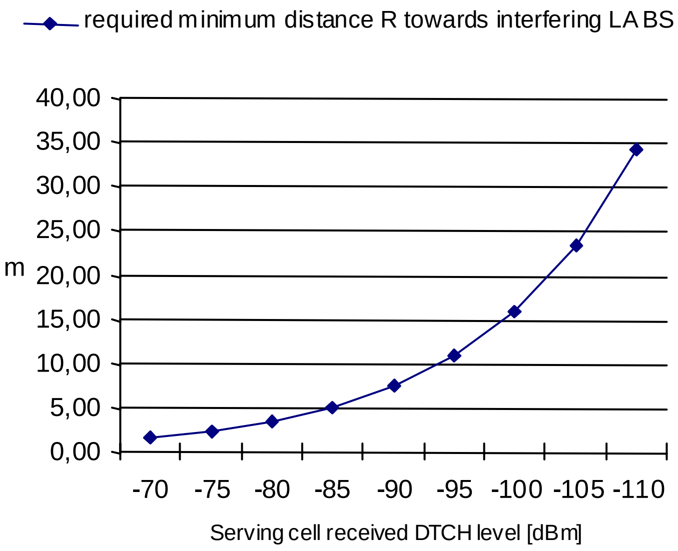

Figure B.1: Localized interference around the LA BS as function of serving cell received DTCH levels

In order to further reduce the likelihood of such localized interference events, the measures presented in the following clause may be applied.

B.1.3~~2~~ Deployment guidelines to reduce interference

The following measures are applicable by the operator of the interfering radio network (i.e. LA or MR network) in order to reduce the likelihood of interference towards an adjacent band operator:

- Avoid allocating LA, MR Node B carriers at the assigned band edge(s) to another operator whenever possible. This may be possible e.g. at an early UMTS deployment phase, where only part of the assigned band may be required.

- During a later UMTS deployment phase, for the case that an operator wishes to deploy 2 WA carriers and one MR or LA carrier, the latter carrier could be "sandwiched" by the WA carriers.

- Ensure sufficiently large MCL conditions across the planned micro cell (or in-building) coverage area. This can be facilitated by choosing suitable antenna types, heights and locations. Note that obtaining a sufficiently high MCL (including antenna gains) is also desirable for the MR or LA network operator due to the –25 dBm/3.84 MHz maximum input level requirement of the UE [25.101]; hence, the MCL will also depend on the intended maximum Node B TX power setting.

- Match the setting of the maximum Node B TX power for MR or LA operation to the requirements (i.e. CL) of propagation environment at hand, i.e. avoid using substantially more TX power than is required for the micro cell or in-building coverage. DL power planning can be facilitated by adjusting the CPICH TX power in such a way that the received CPICH RSCP (or Ec/Io) across the desired coverage area meets the outage target, but on the other hand, is not unnecessarily high. Scaling the windows of the DTCH DL power allocations accordingly, will then also lead to appropriate DTCH power levels.

- Co-ordination between adjacent frequency operators of output powers, antenna sites, heights, gains and patterns, or even co-location of interfering sites. This would reduce worst case situations where a strong interfering signal is received by an adjacent frequency UE connected to a BS at large coupling loss, and thus under relatively poor radio conditions.

For temporary effects, and remaining problems a number of additional system functionalities can be used:

- In case that multiple WA carriers may have become available, the use of IFHO for DL interference avoidance may be used. Hence, the UE may be handed over to the 2nd or 3rd adjacent channel, which will reduce or eliminate the interference.

- In case that adjacent channel interference is encountered within a WA cell, proper setting of the DTCH TX power window can provide the UE with additional power to combat interference. Hence, there is possibility for trading off some capacity / throughput for reducing possible DL coverage holes.

- In case that adjacent channel interference is encountered within a WA cell, reduction of the allocated peak data rate (or AMR codec rate) can provide the UE with additional power to combat interference. Hence, there is possibility for trading off peak data rates for reducing possible DL coverage holes.

- For areas where the received Node B DL signals (or representatively the CPICH RSCP's) from the own and adjacent interfering system differ by much more than 40 dB, own system signal strength may be increased by RNP methods. This can be done by means of directing / tilting antennas beams towards the building in question (e.g. in case of interfering LA network) or by building additional sites.

B.2 Intra-frequency interference

B.2.1 General

The RF specification for Base Stations is to a large extent based on statistical averaging of interference effects and on specific MCL requirement. This should normally be sufficient to eliminate significant interference.

In the case of Local Area and Medium Range BS, also considering some of their likely deployment environments (indoor, street canyons) there is however a high probability that the current UE and BS specifications lead to localised significant intra-frequency interference and then to localised coverage and capacity holes.

This informative Annex highlights through an example the impacts of UE performance requirements on the range of coupling loss that can be operated without degraded the network performance.

B.2.2 Example analysis for localized interference

In this paragraph, the impact of the MCL requirement on UE and BS (either LA or MR) sensitivity is analysed.

B.2.2.1 UL issue

Regarding the UL, a LA or MR BS can be desensitised and suffer from UL capacity/coverage loss if the CL at which the power control causes the UE output power to reduce to the minimum output power is significantly higher than the MCL. In such conditions, if the UE were to move closer to the serving BS, the power control would be unable to reduce the UE output power further, and desensitization would occur.

Then assuming the following parameters (Table B.2) the MCL requirement is compared to the CL value from where a UE reaches its minimum output power.

Table B.2: Assumed parameters for the UL analysis

Parameter	UE Value	LA BS Value	MR BS value	Unit	Notes
UE minimum output power	-50			dBm	from 25.101
BS reference sensitivity level (12.2kbps, BER<0.001)		-107	-111	dBm	from this TR
MCL		45	53	dB	from this TR

The parameters listed in Table B.2 shows that a UE using speech service and served by a LA BS reaches its minimum output power when the coupling loss is such as:

-50 [UE min output power]-CL [coupling loss between UE and serving BS]=

-107 [LA BS reference sensitivity level] + NR [noise rise of the cell corresponding to its load]

That is to say: CL=57dB for an unloaded cell and 51dB for a 75% loaded cell (NR=6dB) while the minimum coupling loss of a LA BS is 45dB.

The parameters listed in Table B.2 shows that a UE using speech service and served by a MR BS reaches its minimum output power when the coupling loss is such as:

-50 [UE min output power]-CL [coupling loss between UE and serving BS]=

-111 [LA BS reference sensitivity level] + NR [noise rise of the cell corresponding to its load]

That is to say: CL=61dB for an unloaded cell and 55dB for a 75% loaded cell (NR=6dB) while the minimum coupling loss of a MR BS is 53dB.

All these evaluated coupling losses are significantly higher than the MCL requirement of the corresponding BS classes. As a result a severe BS desensitisation is expected if a UE is very close to its serving BS.

B.2.2.2 DL issue

Regarding the DL, a LA or MR BS may degrade its own UE's performances and face then DL capacity/coverage loss if the UE received input power level is higher than the maximum requirement.

Then assuming the following parameters (Table B.3) the MCL requirement is compared to the CL value from where a UE received its maximum input power.

Table B.3: Assumed parameters for the DL analysis

Parameter	UE Value	LA BS Value	MR BS value	Unit	Notes
UE maximum input level	-25			dBm	from 25.101
BS maximum output power		24	38	dBm	from this TR
MCL		45	53	dB	from this TR

The parameters listed in Table B.3 show that the maximum received input level of a UE is reached by a serving LA BS transmitting its maximum output power when the coupling loss is such as:

24 [BS maximum output power]-CL [coupling loss between UE and serving BS]=-25 [UE maximum input level]

That is to say: CL=49dB while the minimum coupling loss is 45dB.

The parameters listed in Table B.3 show that the maximum received input level of a UE is reached by a serving MR BS transmitting its maximum output power when the coupling loss is such as:

38 [BS maximum output power]-CL [coupling loss between UE and serving BS]=-25 [UE maximum input level]

That is to say: CL=63dB while the minimum coupling loss is 53dB.

Both these evaluated coupling losses are significantly higher than the MCL requirement of the corresponding BS classes. As a result a UE performances may be degraded by its serving BS.

B.2.3 Deployment guidelines to reduce interference

The following measures may be applied by an operator deploying a LA or a MR network in order to reduce the likelihood of localized interference inside its own network:

- Ensure sufficiently large MCL conditions across the planned micro cell or in-building coverage area. This can be facilitated by choosing suitable antenna types, heights and locations.
- Match the setting of the maximum Node B TX power for MR or LA operation to the requirements (i.e. CL) of propagation environment at hand, i.e. avoid using substantially more TX power than is required for the micro cell or in-building coverage. DL power planning can be facilitated by adjusting the CPICH TX power in such a way that the received CPICH RSCP (or Ec/Io) across the desired coverage area meets the outage target, but on the other hand, is not unnecessarily high. Scaling the windows of the DTCH DL power allocations accordingly, will then also lead to appropriate DTCH power levels.
- Implement efficient handover algorithms to escape low coupling loss situation.

Annex C (informative): Change history

Table C.1:Document history

Date	Version	Comment
14 Sept 2000	0.0.1	Document created
20 Nov 2000	1.0.0	Update based on TSG RAN WG4 meeting #14 approved input documents R4-000835 and R4-000860
30 Jan 2001	1.0.1	Update based on TSG RAN WG4 meeting #15 approved input documents R4-010080 and R4-010081
06 July 2001	1.1.0	Update based on TSG RAN WG4 meeting#17 approved input documents R4-010597 and R4-010598
30 April 2002	1.2.0	Update based on TSG RAN WG4 meeting#21 approved input document R4-020179
5 Nov 2002	1.3.0	Update based on TSG RAN WG4 meeting#24, approved input documents R4-021073, R4-021376 and R4-021377
14 Nov 2002	1.4.0	Update based on TSG RAN WG4 meeting#25, approved input documents R4-021430, R4-021431, R4-021433, R4-021435, R4-021491, R4-021492, R4-021494 and R4-021635.
20 Jan 2003	1.4.1	3GPP formatting, editorial corrections
26 Feb 2003	1.5.0	Update based on TSG RAN WG4 meeting#26, approved input documents R4-030087, R4-030093, R4-030109, R4-030110, R4-030111, R4-030198, R4-030284, R4-030327 and R4-030328. Also changes according to document R4-030358 included. References to R4-021695 and R4-030350 added.
5 Mar 2003	1.5.1	Definition changes according to document R4-030210 included.
7 March 2003	2.0.0	Editorial corrections for presentation to TSG RAN#19
14 March 2003	6.0.0	Approved at TSG RAN #19

Table C.2: Change history

TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
RAN4#13	R4-000572			Document created		0.0.1
RAN#10	RP-000598			25.951- FDD Base Station Classifications	0.0.1	1.0.0
RAN4#16	R4-010257			TR25.951 v.1.0.1	1.0.0	1.0.1
RAN4#18	R4-010896			The changes agreed in R4#17	1.0.0	1.1.0
RAN4#23	R4-020688			Updated version V1.2.0 of TR 25.951 "FDD BS classification"	1.1.0	1.2.0
RAN4#24	R4-021073			Receiver sensitivity for Micro class BS in FDD mode	1.2.0	1.3.0
RAN4#24	R4-021376			Transmitter characteristics for Micro class BS in FDD mode	1.2.0	1.3.0
RAN4#24	R4-021377			Blocking and ACS requirements for Micro class BS in FDD mode	1.2.0	1.3.0
RAN4#25	R4-021430			Simulation results and scenarios for Medium Range BS in FDD mode	1.3.0	1.4.0
RAN4#25	R4-021431			RRM requirement changes for FDD Base Station Classification	1.3.0	1.4.0
RAN4#25	R4-021433			Dynamic range for Medium Range BS in FDD mode	1.3.0	1.4.0
RAN4#25	R4-021435			Proposal for Medium Range BS class output power	1.3.0	1.4.0
RAN4#25	R4-021491			Transmitter characteristics for FDD Local area BS class.	1.3.0	1.4.0
RAN4#25	R4-021492			Receiver characteristics for FDD Local area BS class.	1.3.0	1.4.0
RAN4#25	R4-021494			Changes in TS25.133 according to FDD Local area BS	1.3.0	1.4.0
RAN4#25	R4-021635			Proposal of maximum output power for Local area BS	1.3.0	1.4.0
RAN4#26	R4-021695			Introduction of Base Station Classes for TS 25.141	1.4.1	1.5.0
RAN4#26	R4-030329			Revised version V1.5.0 of TR 25.951 "FDD BS classification"	1.4.1	1.5.0
RAN4#26	R4-030087			Co-siting requirements for different FDD BS classes	1.4.1	1.5.0
RAN4#26	R4-030093			Maximum output power for Medium Range BS class	1.4.1	1.5.0
RAN4#26	R4-030109			ACLR requirement for FDD Local area BS class	1.4.1	1.5.0
RAN4#26	R4-030110			Maximum output power requirement for FDD Local area BS class	1.4.1	1.5.0
RAN4#26	R4-030111			Simulation results and scenarios for Local area BS in FDD mode	1.4.1	1.5.0
RAN4#26	R4-030198			Maximum output power requirement for FDD Medium range BS class	1.4.1	1.5.0
RAN4#26	R4-030284			Proposal of maximum output power for Local Area BS	1.4.1	1.5.0
RAN4#26	R4-030327			Maximum output power requirement for FDD Medium range BS class	1.4.1	1.5.0
RAN4#26	R4-030328			Maximum output power requirement for FDD Local area BS class	1.4.1	1.5.0
RAN4#26	R4-030350			Maximum output power for different BS classes for TS 25.141	1.4.1	1.5.0
RAN4#26	R4-030358			Maximum output power for different BS classes for TS 25.104	1.4.1	1.5.0
RAN4#26	R4-030210			The definition of BS classes.	1.4.1	1.5.1

Table C.3: CR approved at TSG RAN #20

RAN Tdoc	Spec	CR	R	Ph	Title	Cat	Curr	New	Work Item
RP-030221	25.951	001	1	Rel-6	Radio network planning considerations	F	6.0.0	6.1.0	RInImp-BSClass-FDD