TSG-RAN Working Group 1 meeting #14
Oulu, Finland
July 4th – 7th, 2000

TSGR1#14(00)0947

Agenda item:

Source: NEC

Title: CR 25.214-120: Corrections to CL transmit diversity mode 1

Document for: Decision

Though in the current TS 25.214 the antenna weights are not power-normalised in the closed loop transmit diversity mode 1, they should be normalised. Thus, a CR is proposed here.

There is a comment that the equations for antenna verification in Annex A of TS 25.214 should also be normalised. That comment is not incorporated into the proposed CR, because it is considered that the normalisation is automatically reflected to those equations through the channel taps, $h_{2,i}^{(d)}$.

3GPP TSG RAN WG1 Meeting #14
Oulu, Finland, 4-7 July 2000

Document R1-00-0947
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.214	CR	120	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	RAN#9	for approval	X	Strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]

Source: NEC **Date:** July 6, 2000

Subject: Corrections to CL transmit diversity mode 1

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	[X]	**Release:**	Phase 2	[ ]
A	Corresponds to a correction in an earlier release	[ ]		Release 96	[ ]
B	Addition of feature	[ ]		Release 97	[ ]
C	Functional modification of feature	[ ]		Release 98	[ ]
D	Editorial modification	[ ]		Release 99	[X]
				Release 00	[ ]

Reason for change: Transmit powers in CL Tx diversity mode 1 should be normalised.

Clauses affected: 7.2, 7.2.1, 7.2.2

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other GSM core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments:

<--------- double-click here for help and instructions on how to create a CR.

7.2 Closed loop mode 1

UE uses the CPICH transmitted both from antenna 1 and antenna 2 to calculate the phase adjustment to be applied at UTRAN access point to maximise the UE received power. In each slot, UE calculates the optimum phase adjustment, f, for antenna 2, which is then quantized into f_Q having two possible values as follows:

$$f_Q = \begin{cases} p, & \text{if } p/2 < f - f_r(i) \le 3p/2 \\ 0, & \text{otherwise} \end{cases} \quad (2)$$

where:

$$f_r(i) = \begin{cases} 0, & i = 0,2,4,6,8,10,12,14 \\ p/2, & i = 1,3,5,7,9,11,13 \end{cases} \quad (3)$$

If $f_Q = 0$, a command '0' is send to UTRAN using the FSM_{ph} field. Correspondingly, if $f_Q = \pi$, command '1' is send to UTRAN using the FSM_{ph} field.

Due to rotation of the constellation at UE the UTRAN interprets the received commands according to table 9 which shows the mapping between phase adjustment, f_i, and received feedback command for each UL slot.

Table 9: Phase adjustments, f_i, corresponding to feedback commands for the slots *i* of the UL radio frame

Slot #		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
FSM	0	0	π/2	0	π/2	0	π/2	0	π/2	0	π/2	0	π/2	0	π/2	0
	1	π	-π/2	π	-π/2	π	-π/2	π	-π/2	π	-π/2	π	-π/2	π	-π/2	π

The weight vector, w_2, is then calculated by sliding window averaging the received phases over 2 consecutive slots. Algorithmically, w_2 is calculated as follows:

~~$$w_2 = \frac{\sum_{i=n-1}^{n} \cos(f_i)}{\sqrt{2}} + j\frac{\sum_{i=n-1}^{n} \sin(f_i)}{\sqrt{2}}$$~~

$$w_2 = \frac{\sum_{i=n-1}^{n} \cos(f_i)}{2} + j\frac{\sum_{i=n-1}^{n} \sin(f_i)}{2} \quad (4)$$

where:

$$f_i \in \{0, p, p/2, -p/2\} \quad (5)$$

For antenna 1, the weight vector, w_1, is always:

~~$w_1 = 1$~~ $w_1 = 1/\sqrt{2}$ (6)

7.2.1 Mode 1 end of frame adjustment

In closed loop mode 1 at frame borders the sliding window averaging operation is slightly modified. Upon reception of the FB command for slot 0 of the next frame, the average is calculated based on the command for slot 13 of the previous frame and the command for slot 0 of the next frame, i.e. f_i from slot 14 is not used:

~~$$w_2 = \frac{\cos(f_{13}^{j-1}) + \cos(f_0^{j})}{\sqrt{2}} + j\frac{\sin(f_{13}^{j-1}) + \sin(f_0^{j})}{\sqrt{2}}$$~~

$$w_2 = \frac{\cos(f_{13}^{j-1}) + \cos(f_0^{j})}{2} + j\frac{\sin(f_{13}^{j-1}) + \sin(f_0^{j})}{2} \quad (7)$$

where:

- f_{13}^{j-1} = phase adjustment from frame j-1, slot 13.

- f_0^j = phase adjustment from frame j, slot 0.

7.2.2 Mode 1 normal initialisation

For the first frame of transmission UE determines the feedback commands in a normal way and sends them to UTRAN.

Having received the first FB command the UTRAN calculates the w_2 as follows:

~~$$w_2 = \frac{\cos(p/2)+\cos(f_0)}{\sqrt{2}} + j\frac{\sin(p/2)+\sin(f_0)}{\sqrt{2}}$$~~

$$w_2 = \frac{\cos(p/2)+\cos(f_0)}{2} + j\frac{\sin(p/2)+\sin(f_0)}{2} \quad (8)$$

where:

f_0 = phase adjustment from slot 0 of the first frame.