TSG-RAN Working Group 1 meeting #12
Seoul, Korea
April 10 – 13, 2000

TSGR1#12(00)563

Agenda item:

Source: Ericsson

Title: CR 25.211-049r1: PICH undefined bits and AICH, AP-ICH, CD/CA-ICH non-transmitted chips

CR 25.214-092: PICH undefined bits

Document for: Decision

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1 Introduction

The last 12 bits in each PICH radio frame are currently not used and are marked as *undefined* in Release 99.

There are the following problems with this way of specifying this:

- If the bits are undefined in Release 99, but are later defined for some use in Release 2000, then a Release 2000 UE could misinterpret what a Release 99 Node B is transmitting.
- If the bits are defined in Release 99, and the UE uses this knowledge, then a Release 99 UE could get problems with a Release 2000 Node B, if the contents is no longer what the UE assumed.

Hence, if it shall be possible to use those bits in future standard releases, a UE in Release 99 shall neither assume any particular values of those bits nor the fact whether they are transmitted or not.

2 Proposal

It is proposed for Release 99, that the last 12 bits in each PICH radio frame shall not be transmitted. However, the UE shall not make any use of this knowledge, e.g. by performing measurements on an empty code, etc. This makes it possible to use the bits in future standard releases and makes sure that no capacity is wasted for transmission of unused bits.

A similar situation exists for AICH, AP-AICH and CD/CA-ICH, where the last 1024 chips are not transmitted. It is proposed that also for those channels, the UE shall not be allowed to make any use of the knowledge that those chips are not transmitted. Corresponding CRs for TS 25.211 and TS 25.214 are attached.

3 Revision (CR 25.211-049r1)

The revision of the CR for TS 25.211 contains the following changes:

In the case of CA-AICH it appeared in the original CR that the UE should disregard the CSICH, since this is transmitted during the tx-off part of CP-AICH. This situation becomes even more complex if the same channelisation code is shared by AICH and AP-AICH. Based on comments from the group, a different wording is proposed as follows.

For PICH: "The part of the frame with no transmission is reserved for possible future use."

For AICH, AP-AICH, CD/CA-ICH, since the space can be used by CSICH, it would be: "The part of the slot with no transmission is reserved for possible use by CSICH or possible future use by other physical channels."

For CSICH: "The part of the slot with no transmission is reserved for use by AICH, AP-AICH or CD/CA-ICH."

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***Document* R1-00-563**
e.g. for 3GPP use the format TP-99xxx
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25.211	CR	049r1	Current Version:	3.2.0

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

For submission to:	TSG-RAN #8	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: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: Ericsson **Date:** 2000-04-12

Subject: PICH undefined bits and AICH, AP-ICH, CD/CA-ICH non-transmitted chips

Work item:

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

F	Correction	
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	X
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: The last 12 bits in each PICH frame are undefined in Release 99 and it is proposed that those bits shall not be transmitted. The UE shall not make any use of this knowledge. Similarly, it is proposed that the UE shall ignore the fact that the last 1024 chips in a radio frame for AICH, AP-AICH and CD/CA-ICH are not transmitted.

Clauses affected: 5.3.3.6, 5.3.3.7, 5.3.3.8, 5.3.3.9, 5.3.3.10

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: In the case of CA-AICH it appeared in the original CR that the UE should disregard the CSICH, since this is transmitted during the tx-off part of CP-AICH. This situation becomes even more complex if the same channelisation code is shared by AICH and AP-AICH. Similarly it is stated for the CSICH that the non-transmitted chips are used by the AP-AICH.


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5.3.3.6 Acquisition Indicator Channel (AICH)

The Acquisition Indicator channel (AICH) is a physical channel used to carry Acquisition Indicators (AI). Acquisition Indicator AI_s corresponds to signature s on the PRACH.

Figure 21 illustrates the structure of the AICH. The AICH consists of a repeated sequence of 15 consecutive *access slots* (AS), each of length 40 bit intervals. Each access slot consists of two parts, an *Acquisition-Indicator* (AI) part consisting of 32 real-valued symbols a_0, …, a_{31} and a part of duration 1024 chips with no transmission. The part of the slot with no transmission is reserved for possible use by CSICH or possible future use by other physical channels.

The phase reference for the AICH is the Primary CPICH.

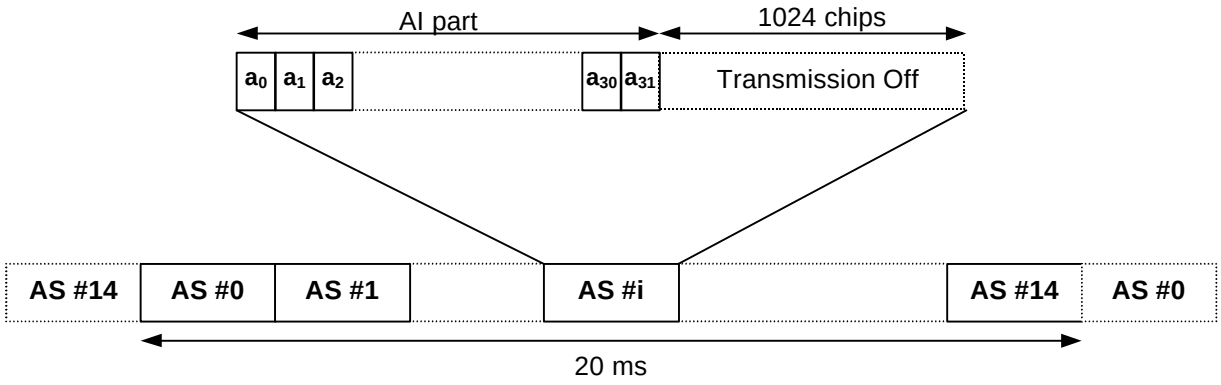

Figure 21: Structure of Acquisition Indicator Channel (AICH)

The real-valued symbols a_0, a_1, …, a_{31} in figure 21 are given by

$$a_j = \sum_{s=0}^{15} AI_s b_{s,j}$$

where AI_s, taking the values +1, -1, and 0, is the acquisition indicator corresponding to signature s and the sequence $b_{s,0}$, …, $b_{s,31}$ is given by table 20.

In case STTD-based open-loop transmit diversity is applied to AICH, STTD encoding according to section 5.3.1.1.1 is applied to each sequence $b_{s,0}$, $b_{s,1}$, ..., $b_{s,31}$ separately before the sequences are combined into AICH symbols a_0, …, a_{31}.

Table 20: AICH signature patterns

s	$b_{s,0}$, $b_{s,1}$…, $b_{s,31}$																															
0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1
2	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1
3	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1
4	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1
5	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1
6	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1
7	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
9	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1
10	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1
11	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1
12	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1
13	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1
14	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	1	1	1	1	-1	-1	-1	-1
15	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1

5.3.3.7 CPCH Access Preamble Acquisition Indicator Channel (AP-AICH)

The Access Preamble Acquisition Indicator channel (AP-AICH) is a physical channel used to carry AP acquisition indicators (API) of CPCH. AP acquisition indicator API corresponds to AP signature *s* transmitted by UE.

AP-AICH and AICH may use the same or different channelisation codes. The phase reference for the AP-AICH is the Primary CPICH. Figure 22 illustrates the structure of AP-AICH. The AP-AICH has a part of duration of 4096 chips where the AP acquisition indicator (API) is transmitted, followed by a part of duration 1024 chips with no transmission. The part of the slot with no transmission is reserved for possible use by CSICH or possible future use by other physical channels.

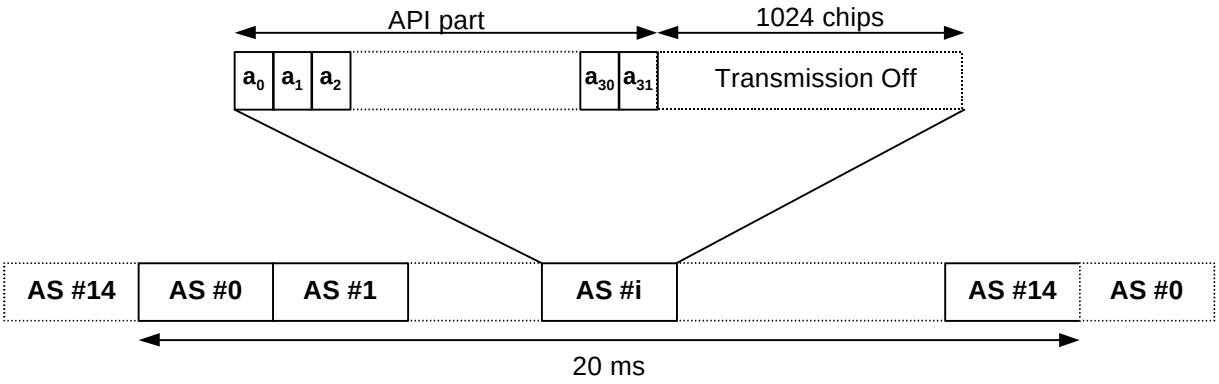

Figure 22: Structure of AP Acquisition Indicator Channel (AP-AICH)

The real-valued symbols a_0, a_1, …, a_{31} in figure 22 are given by

$$a_j = \sum_{s=0}^{15} API_s \times b_{s,j}$$

where API_s, taking the values +1, -1, and 0, is the AP acquisition indicator corresponding to Access Preamble signature s transmitted by UE and the sequence $b_{s,0}$, …, $b_{s,31}$ is given in Table 20.

In case STTD-based open-loop transmit diversity is applied to AP-AICH, STTD encoding according to section 5.3.1.1.1 is applied to each sequence $b_{s,0}$, $b_{s,1}$, ..., $b_{s,31}$ separately before the sequences are combined into AP-AICH symbols a_0, …, a_{31}.

5.3.3.8 CPCH Collision Detection/Channel Assignment Indicator Channel (CD/CA-ICH)

The Collision Detection Channel Assignment Indicator channel (CD/CA-ICH) is a physical channel used to carry CD Indicator (CDI) only if the CA is not active, or CD Indicator/CA Indicator (CDI/CAI) at the same time if the CA is active. The structure of CD/CA-ICH is shown in figure 23. CD/CA-ICH and AP-AICH may use the same or different channelisation codes.

The CD/CA-ICH has a part of duration of 4096 chips where the CDI/CAI is transmitted, followed by a part of duration 1024 chips with no transmission. The part of the slot with no transmission is reserved for possible use by CSICH or possible future use by other physical channels.

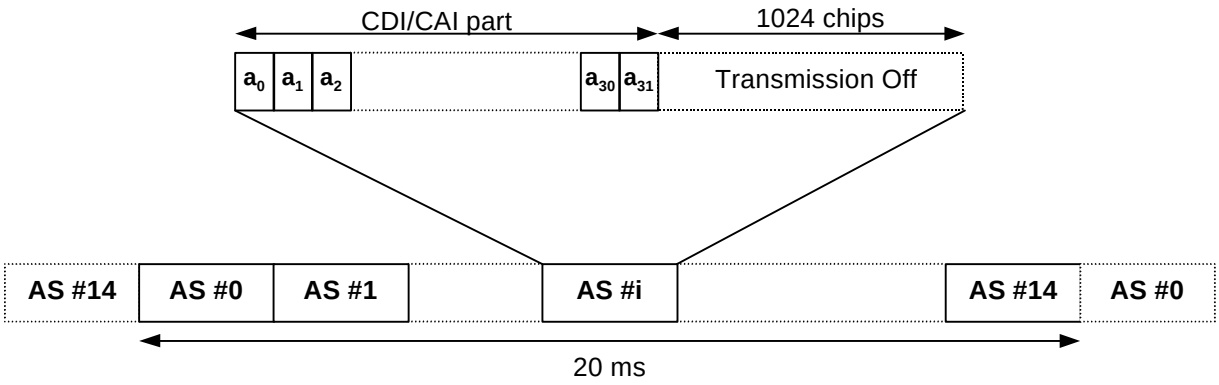

Figure 23: Structure of CD/CA Indicator Channel (CD/CA-ICH)

In case STTD-based open-loop transmit diversity is applied to AP-AICH, STTD encoding according to section 5.3.1.1.1 is applied to each sequence $b_{s,0}$, $b_{s,1}$, ..., $b_{s,31}$ separately before the sequences are combined into CD/CA-ICH symbols a_0, …, a_{31}.

In case CA is not active, the real-valued symbols a_0, a_1, …, a_{31} in figure 23 are given by

$$a_j = \sum_{s=0}^{15} CDI_s \times b_{s,j}$$

where CDI_s, taking the values +1, and 0, is the CD indicator corresponding to CD preamble signature *s* transmitted by UE and the sequence $b_{s,0}$, …, $b_{s,31}$ is given in table 20.

In case CA is active, the real-valued symbols a_0, a_1, …, a_{31} in figure 23 are given by

$$a_j = \sum_{i=0}^{15} CDI_i \times b_{s_i,j} + \sum_{k=0}^{15} CAI_k \times b_{s_k,j}$$

where the subscript s_i, s_k depend on the indexes *i*, *k* according to table 21, respectively, and indicate the signature number *s* in table 20. The sequence $b_{s,0}$, …, $b_{s,31}$ is given in table 20. CDI_i, taking the values +1/0 or -1/0, is the CD indicator corresponding to the CD preamble *i* transmitted by the UE, and CAI_k, taking the values +1/0 or -1/0, is the CA indicator corresponding to the assigned channel index *k* as given in table 21.

Table 21. Generation of CDI_i/CAI_k

UE transmitted CD Preamble *i*	CDI_i	signature s_i	Channel Assignment Index *k*	CAI_k	signature s_k
0	+1/0	1	0	+1/0	0
1	-1/0		1	-1/0	
2	+1/0	3	2	+1/0	8
3	-1/0		3	-1/0	
4	+1/0	5	4	+1/0	4
5	-1/0		5	-1/0	
6	+1/0	7	6	+1/0	12
7	-1/0		7	-1/0	
8	+1/0	9	8	+1/0	2
9	-1/0		9	-1/0	
10	+1/0	11	10	+1/0	6
11	-1/0		11	-1/0	
12	+1/0	13	12	+1/0	10
13	-1/0		13	-1/0	
14	+1/0	15	14	+1/0	14
15	-1/0		15	-1/0	

5.3.3.9 Paging Indicator Channel (PICH)

The Paging Indicator Channel (PICH) is a fixed rate (SF=256) physical channel used to carry the Paging Indicators (PI). The PICH is always associated with an S-CCPCH to which a PCH transport channel is mapped.

Figure 24 illustrates the frame structure of the PICH. One PICH radio frame of length 10 ms consists of 300 bits (b_0, b_1, …, b_{299}). Of these, 288 bits (b_0, b_1, …, b_{287}) are used to carry Paging Indicators. The remaining 12 bits (b_{288}, b_{289}, …, b_{299}) ~~are undefined.~~shall not be transmitted. The part of the frame with no transmission is reserved for possible future use.

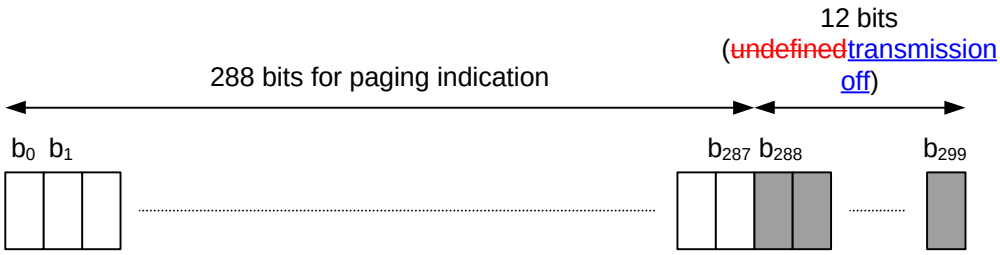

Figure 24: Structure of Paging Indicator Channel (PICH)

N Paging Indicators {PI_0, …, PI_{N-1}} are transmitted in each PICH frame, where N=18, 36, 72, or 144.

The PI calculated by higher layers for use for a certain UE, is mapped to the paging indicator PI_p, where p is computed as a function of the PI computed by higher layers, the SFN of the P-CCPCH radio frame during which the start of the PICH radio frame occurs, and the number of paging indicators per frame (N):

$$p = \left(PI + \left\lfloor \left(\left(18 \times \left(SFN + \lfloor SFN/8 \rfloor + \lfloor SFN/64 \rfloor + \lfloor SFN/512 \rfloor \right) \right) \bmod 144 \right) \times \frac{N}{144} \right\rfloor \right) \bmod N .$$

The mapping from {PI_0, …, PI_{N-1}} to the PICH bits {b_0, …, b_{287}} are according to table 22.

Table 22: Mapping of Paging Indicators (PI) to PICH bits

Number of PI per frame (N)	$PI_p = 1$	$PI_p = 0$
N=18	$\{b_{16p}, \ldots, b_{16p+15}\} = \{1,1,\ldots,1\}$	$\{b_{16p}, \ldots, b_{16p+15}\} = \{0,0,\ldots,0\}$
N=36	$\{b_{8p}, \ldots, b_{8p+7}\} = \{1,1,\ldots,1\}$	$\{b_{8p}, \ldots, b_{8p+7}\} = \{0,0,\ldots,0\}$
N=72	$\{b_{4p}, \ldots, b_{4p+3}\} = \{1, 1,\ldots,1\}$	$\{b_{4p}, \ldots, b_{4p+3}\} = \{0, 0,\ldots,0\}$
N=144	$\{b_{2p}, b_{2p+1}\} = \{1,1\}$	$\{b_{2p}, b_{2p+1}\} = \{0,0\}$

If a Paging Indicator in a certain frame is set to "1" it is an indication that UEs associated with this Paging Indicator should read the corresponding frame of the associated S-CCPCH.

When transmit diversity is employed for the PICH, STTD encoding is used on the PICH bits as described in section 5.3.1.1.1.

5.3.3.10 CPCH Status Indicator Channel (CSICH)

The CPCH Status Indicator Channel (CSICH) is a fixed rate (SF=256) physical channel used to carry CPCH status information.

A CSICH is always associated with a physical channel used for transmission of CPCH AP-AICH and uses the same channelization and scrambling codes. Figure 25 illustrates the frame structure of the CSICH. The CSICH frame consists of 15 consecutive access slots (AS) each of length 40 bits. Each access slot consists of two parts, a part of duration 4096 chips with no transmission, and a Status Indicator (SI) part consisting of 8 bits $b_{8i},\ldots b_{8i+7}$, where i is the access slot number. The part of the slot with no transmission is reserved for use by AICH, AP-AICH or CD/CA-ICH. The modulation used by the CSICH is the same as for the PICH. The phase reference for the CSICH is the Primary CPICH.

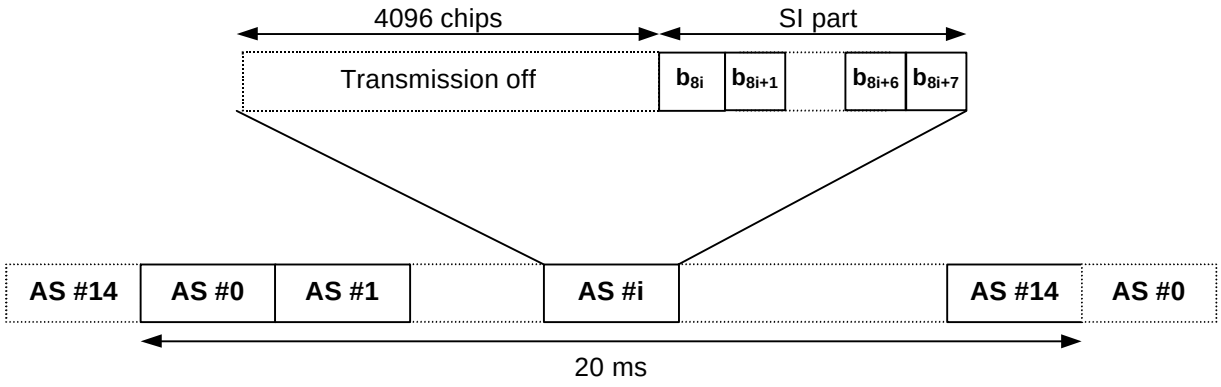

Figure 25: Structure of CPCH Status Indicator Channel (CSICH)

N Status Indicators $\{SI_0, \ldots, SI_{N-1}\}$ shall be transmitted in each CSICH frame. The mapping from $\{SI_0, \ldots, SI_{N-1}\}$ to the CSICH bits $\{b_0, \ldots, b_{119}\}$ is according to table 23. The Status Indicators shall be transmitted in all the access slots of the CSICH frame, even if some signatures and/or access slots are shared between CPCH and RACH.

Table 23: Mapping of Status Indicators (SI) to CSICH bits

Number of SI per frame (N)	$SI_n = 1$	$SI_n = 0$
N=1	$\{b_0, \ldots, b_{119}\} = \{1,1,\ldots,1\}$	$\{b_0, \ldots, b_{119}\} = \{0,0,\ldots,0\}$
N=3	$\{b_{40n}, \ldots, b_{40n+39}\} = \{1,1,\ldots,1\}$	$\{b_{40n}, \ldots, b_{40n+39}\} = \{0,0,\ldots,0\}$
N=5	$\{b_{24n}, \ldots, b_{24n+23}\} = \{1,1,\ldots,1\}$	$\{b_{24n}, \ldots, b_{24n+23}\} = \{0,0,\ldots,0\}$
N=15	$\{b_{8n}, \ldots, b_{8n+7}\} = \{1,1,\ldots,1\}$	$\{b_{8n}, \ldots, b_{8n+7}\} = \{0,0,\ldots,0\}$
N=30	$\{b_{4n}, \ldots, b_{4n+3}\} = \{1, 1, 1, 1\}$	$\{b_{4n}, \ldots, b_{4n+3}\} = \{0, 0, 0, 0\}$
N=60	$\{b_{2n}, b_{2n+1}\} = \{1,1\}$	$\{b_{2n}, b_{2n+1}\} = \{0,0\}$

When transmit diversity is employed for the CSICH, STTD encoding is used on the CSICH bits as described in subclause 5.3.1.1.1.

At the UTRAN the values of the Status Indicators are set by higher layers.

At the UE the number of status indicators per frame is a higher layer parameter. The higher layers shall provide Layer 1 with the mapping between the values of the Status Indicators and the availability of CPCH resources.

3GPP TSG RAN WG1 Meeting #12
Seoul, Korea, Apr 10 – 13, 2000

***Document* R1-00-563**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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25.214	CR	092	Current Version:	3.2.0

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

For submission to:	TSG-RAN #8	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: Ericsson **Date:** 2000-04-07

Subject: PICH undefined bits

Work item:

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

F	Correction	
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	X
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: The last 12 bits in each PICH frame are undefined in Release 99 and it is proposed that those bits shall not be transmitted. Hence, it is not necessary to mention that the PICH power shall be be measured over the undefined bits.

Clauses affected: 5.2.4

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:

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5.2.4 PICH

The UE is informed about the relative transmit power of the PICH (measured as the power over the ~~transmitted~~ paging indicators~~, excluding the undefined part of the PICH frame~~) compared to the primary CPICH transmit power by the higher layers.