**Agenda item:**

**Source:** **Philips**

**Title:** **Correction on indicators**

**Document for:** **Decision**

## Introduction

The explicit meaning of certain downlink indicators (AICH and AP-AICH) is not currently stated in the specifications. It is proposed to add clarifying statements in 25.211, sections 4.2, 5.3.3.6 and 5.3.3.7. This will avoid possible ambiguity in interpretation by the UE.

# CHANGE REQUEST

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

| **25.211** | CR | **072** | 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* |
|---|---|---|---|---|---|---|
| *list expected approval meeting # here* ↑ | | for information | | non-strategic | | *use only)* |

*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:** | Philips | **Date:** | 2000-14-08 |
|---|---|---|---|

| **Subject:** | Correction on indicators |
|---|---|

| **Work item:** | |
|---|---|

**Category:**    F  Correction    **X**    **Release:**    Phase 2 [ ]
                 A  Corresponds to a correction in an earlier release [ ]    Release 96 [ ]
*(only one category*    B  Addition of feature [ ]    Release 97 [ ]
*shall be marked*    C  Functional modification of feature [ ]    Release 98 [ ]
*with an X)*    D  Editorial modification [ ]    Release 99 **X**
                                                                Release 00 [ ]

| **Reason for change:** | Explicit meaning of certain indicators should be stated. |
|---|---|

| **Clauses affected:** | 4.2, 5.3.3.6, 5.3.3.7 |
|---|---|

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

### 4.1.1.1 DCH - Dedicated Channel

The Dedicated Channel (DCH) is a downlink or uplink transport channel. The DCH is transmitted over the entire cell or over only a part of the cell using e.g. beam-forming antennas.

## 4.1.2 Common transport channels

There are six types of common transport channels: BCH, FACH, PCH, RACH, CPCH and DSCH.

### 4.1.2.1 BCH - Broadcast Channel

The Broadcast Channel (BCH) is a downlink transport channel that is used to broadcast system- and cell-specific information. The BCH is always transmitted over the entire cell and has a single transport format.

### 4.1.2.2 FACH - Forward Access Channel

The Forward Access Channel (FACH) is a downlink transport channel. The FACH is transmitted over the entire cell or over only a part of the cell using e.g. beam-forming antennas. The FACH can be transmitted using slow power control.

### 4.1.2.3 PCH - Paging Channel

The Paging Channel (PCH) is a downlink transport channel. The PCH is always transmitted over the entire cell. The transmission of the PCH is associated with the transmission of physical-layer generated Paging Indicators, to support efficient sleep-mode procedures.

### 4.1.2.4 RACH - Random Access Channel

The Random Access Channel (RACH) is an uplink transport channel. The RACH is always received from the entire cell. The RACH is characterized by a collision risk and by being transmitted using open loop power control.

### 4.1.2.5 CPCH - Common Packet Channel

The Common Packet Channel (CPCH) is an uplink transport channel. CPCH is associated with a dedicated channel on the downlink which provides power control and CPCH Control Commands (e.g. Emergency Stop) for the uplink CPCH. The CPCH is characterised by initial collision risk and by being transmitted using inner loop power control.

### 4.1.2.6 DSCH - Downlink Shared Channel

The Downlink Shared Channel (DSCH) is a downlink transport channel shared by several UEs The DSCH is associated with one or several downlink DCH. The DSCH is transmitted over the entire cell or over only a part of the cell using e.g. beam-forming antennas.

## 4.2 Indicators

Indicators are means of fast low-level signalling entities which are transmitted without using information blocks sent over transport channels. The meaning of indicators is ~~implicit to the receiver~~specific to the type of indicator.

The indicators defined in the current version of the specifications are: Acquisition Indicator (AI), Access Preamble Indicator (API), Channel Assignment Indicator (CAI), Collision Detection Indicator (CDI), Page Indicator (PI) and Status Indicator (SI).

Indicators may be either boolean (two-valued) or three-valued. Their mapping to indicator channels is channel specific.

Indicators are transmitted on those physical channels that are indicator channels (ICH).

In case of TFCI based signalling, the TFCI informs the UE of the instantaneous transport format parameters related to the PDSCH as well as the channelisation code of the PDSCH.

In the other case, the information is given by higher layer signalling.

The channel bit rates and symbol rates for PDSCH are given in table 19.

For PDSCH the allowed spreading factors may vary from 256 to 4.

**Table 19: PDSCH fields**

| Slot format #i | Channel Bit Rate (kbps) | Channel Symbol Rate (ksps) | SF | Bits/ Frame | Bits/ Slot | $N_{data}$ |
|---|---|---|---|---|---|---|
| 0 | 30 | 15 | 256 | 300 | 20 | 20 |
| 1 | 60 | 30 | 128 | 600 | 40 | 40 |
| 2 | 120 | 60 | 64 | 1200 | 80 | 80 |
| 3 | 240 | 120 | 32 | 2400 | 160 | 160 |
| 4 | 480 | 240 | 16 | 4800 | 320 | 320 |
| 5 | 960 | 480 | 8 | 9600 | 640 | 640 |
| 6 | 1920 | 960 | 4 | 19200 | 1280 | 1280 |

When open loop transmit diversity is employed for the PDSCH, STTD encoding is used on the data bits as described in subclause 5.3.1.1.1.

## 5.3.3.6 Acquisition Indicator Channel (AICH)

The Acquisition Indicator channel (AICH) is a fixed rate (SF=256) 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 5120 chips. Each access slot consists of two parts, an *Acquisition-Indicator* (AI) part consisting of 32 real-valued symbols $a_0, \ldots, a_{31}$ and a part of duration 1024 chips with no transmission that is not formally part of the AICH. The part of the slot with no transmission is reserved for possible use by CSICH or possible future use by other physical channels.

The spreading factor (SF) used for channelization of the AICH is 256.

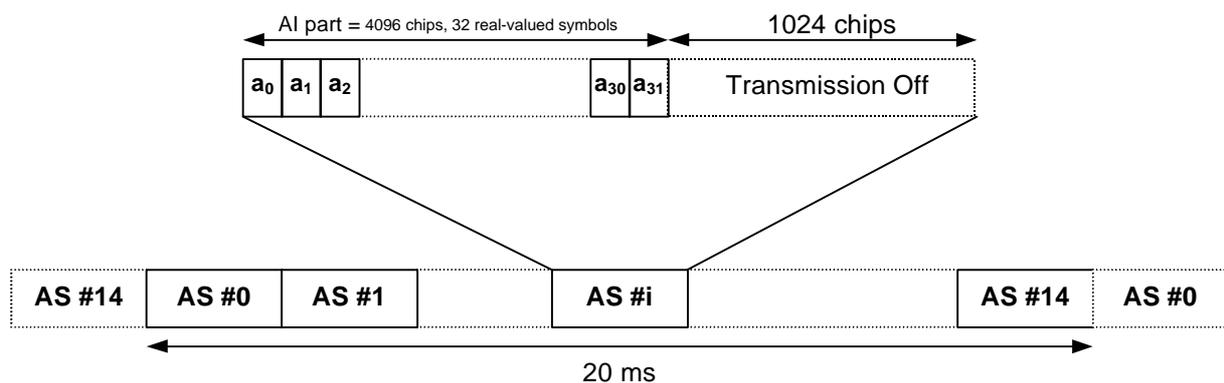The phase reference for the AICH is the Primary CPICH.

**Figure 21: Structure of Acquisition Indicator Channel (AICH)**

The real-valued symbols $a_0, a_1, \ldots, a_{31}$ 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.

If an Acquisition Indicator is set to +1, it represents a positive acknowledgement. If an Acquisition Indicator is set to -1, it represents a negative acknowledgement.

The real-valued symbols, $a_j$, are spread and modulated in the same fashion as bits when represented in { +1, -1 } form.

In case STTD-based open-loop transmit diversity is applied to AICH, STTD encoding according to subclause 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 fixed rate (SF=256) physical channel used to carry AP acquisition indicators (API) of CPCH. AP acquisition indicator $API_s$ 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 4096 chips where the AP acquisition indicator (API) is transmitted, followed by a part of duration 1024chips with no transmission that is not formally part of the AP-AICH. The part of the slot with no transmission is reserved for possible use by CSICH or possible future use by other physical channels.

The spreading factor (SF) used for channelization of the AP-AICH is 256.



**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.

If an AP acquisition indicator is set to +1, it represents a positive acknowledgement. If an AP acquisition indicator is set to -1, it represents a negative acknowledgement.

The real-valued symbols, $a_j$, are spread and modulated in the same fashion as bits when represented in { +1, -1 } form.

In case STTD-based open-loop transmit diversity is applied to AP-AICH, STTD encoding according to subclause 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 fixed rate (SF=256) 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 4096chips where the CDI/CAI is transmitted, followed by a part of duration 1024chips with no transmission that is not formally part of the CD/CA-ICH. The part of the slot with no transmission is reserved for possible use by CSICH or possible future use by other physical channels.

The spreading factor (SF) used for channelization of the CD/CA-ICH is 256.
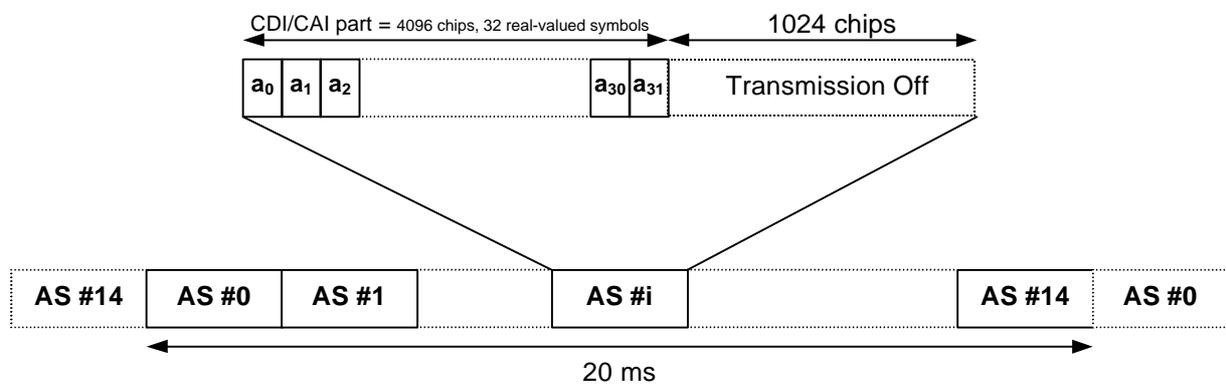


**Figure 23: Structure of CD/CA Indicator Channel (CD/CA-ICH)**

In case STTD-based open-loop transmit diversity is applied to CD/CA-ICH, STTD encoding according to subclause 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.

The real-valued symbols, $a_j$, are spread and modulated in the same fashion as bits when represented in { +1, -1 } form.