TSG-RAN Working Group 1 meeting #11
San Diego, USA
February 29 – March 03, 2000

TSGR1#11(00)241

Agenda item: AH 04

Source: Ericsson

Title: CR 25.212-029r1: Limitations of blind transport format detection

Document for: Decision

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1 Introduction

It is mandatory for all UEs to support downlink transport format detection through the use of TFCI. The support of blind transport format detection (BTFD) in case of no TFCI will lead to increased complexity in the UE. The extent of additional complexity does considerably depend on how BTFD shall be supported by the UEs. From the current specification in TS 25.212, this is not clearly defined. The goal of this CR is to define clearly under which limitations BTFD shall by supported by the UE.

2 Objective with specification text on BTFD

BTFD shall, if clearly defined restrictions are fulfilled, be mandatory to be supported in the UE. It is not reasonable to define BTFD a UE capability, since the UE manufacturers will have no incentive to support such detection (no added value for the user). Since probably AMR as a low rate common service is the main target service to support using BTFD, it is assumed that it shall be possible to blindly detect AMR + DCCH + rate control. The restrictions and requirements shall be formulated in a general way, e.g. “AMR” shall not be mentioned in the specifaction text.

3 Blind transport format detection principles

In order to define the restrictions under which BTFD shall be possible, we first define the two basic transport format detection methods that are available when there is no TFCI and the transport format set of the transport channel under consideration contains more than one transport format. If the transport channel has only one transport format, this transport format is known directly to the receiver and no blind detection needs to be performed for this transport channel.

3.1 Explicit blind detection

The transport channel has more than one transport format. The transport format of the transport channel is typically detected by testing different transport formats through channel decoding and checking for a correct CRC.

3.2 Guided detection

The transport channel has more than one transport format. The transport format of the transport channel is determined through determination of the transport format of another so called *guiding transport channel*. The transport format of the guiding transport channel is explicitly detected and the guiding transport channel shall have the same TTI as the transport channel under consideration. Guided detection is only possible if different transport formats of the transport channel under consideration correspond to different transport formats of the guiding transport channel. It is however not necessary that different transport formats of the guiding transport channel correspond to different transport formats of the transport channel under consideration.

An example is given in the following table (TrCH A and TrCH B use guided detection):

Guiding TrCH	TrCH A	TrCH B
TF 0	TF 0	TF 0
TF 1	TF 1	TF 0
TF 2	TF 0	TF 0
TF 3	TF 2	TF 1

4 Proposed requirements for UE support of BTFD

Based on the aboved definitions and objectives, it is proposed that it is mandatory for the UEs to support BTFD in the downlink, for normal and compressed mode, under the following restrictions on the configured transport channels:

1) **The number of CCTrCH bits received per radio frame is 600 or less.**
   In order to limit the decoding time and complexity, it is necessary to limit the CCTrCH bit rate. For Release 99, BTFD shall be possible for low data rate services, so 600 bits is seen as a reasonable limitation.

2) **The number of transport format combinations of the CCTrCH is 64 or less.**
   The number of transport format combinations needs to be limited for BTFD in order to limit e.g., the memory requirements in the UE. It is believed that for typical applications using BTFD, a maximum of 64 TFC is a sensible limitation. If UE capabilities set a lower maximum, then the UE is only required to support *min* (UE cap, 64) TFCs for BTFD.

3) **Fixed positions of the transport channels is used on the CCTrCH to be detected.**
   It is commonly understood that the use of fixed positions enables an efficient implementation of BTFD.

4) **Convolutional coding is used on all explicitely detected TrCHs.**
   Channel decoding needs to be performed frequently (see also requirement 8) to detect the transport format for a TrCH. It is therefore sensible to limit BTFD to TrCHs using convolutional encoding only.

5) **CRC is appended to all transport blocks on all explicitely detected TrCHs.**
   Typically, CRC check will be used to detect the correct transport format of a TrCH.

6) **The number of explicitely detected TrCHs is 3 or less.**
   Not more than 3 explicitely detected TrCHs will be needed for detection of AMR services (AMR, DCCH, rate control). It is believed that also for other low rate services (e.g., S-CCPCH) this limit is sufficient. Together with limitation 8 this limits the processing requirements for BTFD in the UE.

7) **For all explicitely detected TrCHs *i*, the number of code blocks in one TTI (C_i) shall not exceed 1.**
   In order to limit the amount of multiple decoding, code block segmentation should be avoided for the case of BTFD.

8) **The sum of the transport format set sizes of all explicitely detected TrCHs, is 16 or less.**
   The transport format set size is defined as the number of transport formats within the transport format set. This number can be interpreted as the maximum total number of detection attempts to be performed for one CCTrCH.

9) **There is at least one TrCH that can be used as the guiding transport channel for all transport channels using guided detection.**
   The UTRAN has to provide at least one TrCH that can be used as guiding TrCH for *all* TrCHs that use guided detection. However, it is not mandatory for the UE to support guided detection through several guiding TrCHs. The guiding TrCH is determined by the UE, i.e. it is not explicitely signalled.

5 Conclusion

From the current specification in TS 25.212, it is not clear how BTFD shall be supported by the UE. It is proposed to introduce limitations on blind transport format detection into section 4.3 and 4.3.1 of TS 25.212. The attached revised CR reflects the outcome of thorough discussions on the WG1 reflector.

3GPP TSG RAN WG1 Meeting #10
San Diego, USA, Feb 29 – Mar 3, 2000

Document ????9???
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.

25.212	CR	029r1	Current Version:	3.1.0

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

For submission to:	TSG-RAN #7	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:** 2000-02-24

Subject: Limitations of blind transport format detection

Work item:

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

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

Release:

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

Reason for change: The limitations of blind transport format detection are not specified yet.

Clauses affected: 4.3, 4.3.1, 4.3.2

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:

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4.3 Transport format detection

~~Transport format detection can be performed both with and without Transport Format Combination Indicator (TFCI). If a TFCI is transmitted, the receiver detects the transport format combination from the TFCI. When no TFCI is transmitted, so called blind transport format detection may be used, i.e. the receiver side detects the transport format combination using some information, e.g. received power ratio of DPDCH to DPCCH, CRC check results.~~

~~For uplink, the blind transport format detection is an operator option. For downlink, the blind transport format detection can be applied with convolutional coding, the maximum number of different transport formats and maximum data rates allowed shall be specified.~~If the transport format set of a TrCH *i* contains more than one transport format, the transport format can be detected according to one of the following methods:

- TFCI based detection: This method is applicable when the transport format combination is signalled using the TFCI field.
- Explicit blind detection: This method typically consists of detecting the TF of TrCH *i* by use of channel decoding and CRC check.
- Guided detection: This method is applicable when there is at least one other TrCH *i'*, hereafter called guiding TrCH, such that:
  - the guiding TrCH has the same TTI duration as the TrCH under consideration, i.e. $F_{i'} = F_i$
  - different TFs of the TrCH under consideration correspond to different TFs of the guiding TrCH
  - explicit blind detection is used on the guiding TrCH.

If the transport format set for a TrCH *i* contains one transport format only, no transport format detection needs to be performed for this TrCH.

For uplink, blind transport format detection is a network controlled option. For downlink, the UE shall be capable of performing blind transport format detection, if certain restrictions on the configured transport channels are fulfilled.

4.3.1 Blind transport format detection

When no TFCI is available then explicit blind detection or guided detection shall be performed on all TrCHs within the CCTrCH that have more than one transport format. The UE shall only be required to support blind transport format detection if all of the following restrictions are fulfilled:

1. The number of CCTrCH bits received per radio frame is 600 or less.
2. The number of transport format combinations of the CCTrCH is 64 or less.
3. Fixed positions of the transport channels is used on the CCTrCH to be detected.
4. Convolutional coding is used on all explicitely detected TrCHs.
5. CRC is appended to all transport blocks on all explicitely detected TrCHs.
6. The number of explicitely detected TrCHs is 3 or less.
7. For all explicitely detected TrCHs *i*, the number of code blocks in one TTI (C_i) shall not exceed 1.
8. The sum of the transport format set sizes of all explicitely detected TrCHs, is 16 or less. The transport format set size is defined as the number of transport formats within the transport format set.
9. There is at least one TrCH that can be used as the guiding transport channel for all transport channels using guided detection.

Examples of blind transport format detection methods are given in Annex A.

4.3.2 ~~Explicit t~~Transport format detection based on TFCI

If a TFCI is available, then TFCI based detection shall be applicable to all TrCHs within the CCTrCH. The ~~Transport Format Combination Indicator (~~TFCI~~)~~ informs the receiver ~~of~~ about the transport format combination of the CCTrCHs. As soon as the TFCI is detected, the transport format combination, and hence the transport formats of the individual transport channels~~' transport formats~~ are known.~~, and decoding of the transport channels can be performed.~~