

**Agenda item:**

**Source:** Ericsson

**Title:** CR 25.212-029: 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 be 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 specification text.

## 3 Transport format detection principles

In order to define the restrictions under which BTFD shall be possible, we first define the three basic transport format detection methods that are available when there is no TFCI.

### 3.1 Direct detection

The transport channel has only one transport format, and hence the transport format is known directly to the receiver.

### 3.2 Explicit 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 and checking for a correct CRC.

### 3.3 Implicit 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. Implicit detection is only possible if different transport formats of the transport channel correspond to different transport formats of the guiding transport channel.

## 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 downlink physical channel bit rate in normal (non-compressed) mode is 60 kbps or less**  
This restriction limits the amount of processing in the UE.
- 2) **Convolutional coding is used on all explicitly detected transport channels**  
Simple Trellis backtracking is possible for convolutional codes only.
- 3) **CRC is appended to all transport blocks on all explicitly detected transport channels**  
The application of CRC provides the means for reliable transport format detection.
- 4) **Fixed positions of the transport channels is used on the CCTrCHs to be detected**  
The use of fixed positions has been the basis for the BTFD idea.
- 5) **The sum of the transport format set sizes for the explicitly detected transport channels is 16 or less**  
This limits the total number of rate determination attempts that have to be performed in the UE.
- 6) **The number of explicitly detected transport channels is 3 or less**  
The UE has to determine, *which* explicitly detected transport channel the implicitly detected transport channels are related to. This restriction limits the “intelligence” needed in UE.
- 7) **All implicitly detected transport channels have the same guiding transport channel**  
Explicit detection of only *one* of the transport channels is required to determine the transport formats of all implicitly detected transport channels. This restriction also limits the “intelligence” needed in UE.
- 8) **For each of the implicitly detected transport channels, different transport formats must correspond to different transport formats of the guiding transport channel**  
One transport format detected on the guiding transport channel corresponds to only one possible transport format on the implicitly detected transport channel.

## 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 4.3.1 of TS 25.212.



## 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 indirect information, e.g. received power ratio of DPDCH to DPCCCH, CRC check results etc.

~~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.~~

### 4.3.1 Blind transport format detection

When blind transport format detection is employed, the detection of the transport format for the different transport channels can be either direct, explicit or implicit. The three different detection methods are characterised as follows.

Direct detection:

- The transport channel has only one transport format, and hence the transport format is known directly to the receiver.

Explicit 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 and checking for a correct CRC.

Implicit 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.

For uplink, blind transport format detection is a network controlled option.

For downlink, the UE shall be capable of performing blind transport format detection, both in normal mode and compressed mode, if all of the following restrictions on the configured transport channels are fulfilled:

- The downlink physical channel bit rate in normal (non-compressed) mode is 60 kbps or less.
- Convolutional coding is used on all explicitly detected transport channels.
- CRC is appended to all transport blocks on all explicitly detected transport channels.
- Fixed positions of the transport channels is used on the CCTrCHs to be detected.
- The number of explicitly detected transport channels is 3 or less.
- The sum of the transport format set sizes for the explicitly detected transport channels is 16 or less. The transport format set size is defined as the number of transport formats within the transport format set.
- All implicitly detected transport channels have the same guiding transport channel, i.e. explicit detection of only one of the transport channels is required in order to determine the transport formats of all the implicitly detected transport channels.
- For each of the implicitly detected transport channels, different transport formats must correspond to different transport formats of the guiding transport channel.

If any of the above restrictions is not fulfilled, the UE shall not be required to be able to do blind transport format detection.

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