

# Exhibit 1005

**Source:** InterDigital Comm. Corp.  
**Title:** Implicit UE Identification for HSDPA Downlink Signaling  
**Document for:** Discussion

## 1.0 Introduction

Reference [2] proposed two encoding strategies for the HS-PDSCCH that eliminate the need for explicit UE ID when an HS-DSCH Indicator (HI) is present.

These were:

- A UE specific scrambling code
- A UE-specific CRC

In the second strategy, a UE-specific CRC may be constructed by requiring that the 16-bit MAC UE ID be concatenated with the control information and passed through the CRC generator polynomial. As a result, the CRC generated will be a function of the UE ID. However, the UE ID is never transmitted over the air.

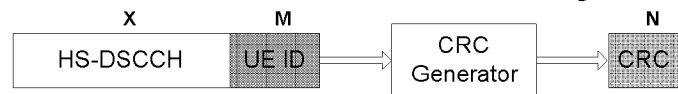
This document supports the use of the UE-specific CRC because it is simple and effective and applicable equally to FDD and TDD.

In the discussion of reference [2] in Espoo, InterDigital Comm. Corp. supported the basic approach of UE-specific CRC, but suggested that there are other implementations that may provide the same fundamental benefit with somewhat simpler implementation.

This contribution identifies two alternative implementations for the UE-specific CRC.

## 2.0 Review of Concatenation Approach

The UE-specific CRC method described in [2] is implemented by using the MAC UE ID concatenated with control information to generate CRC as depicted in the figure below:



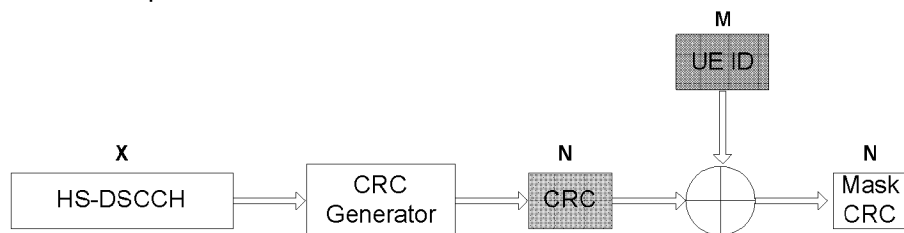
The common control channel HS-DSCCH carries UE specific control information as shown below:



### 3.0 Alternative Implementations

This section defines two alternative implementations, which provide benefits of the UE-specific CRC.

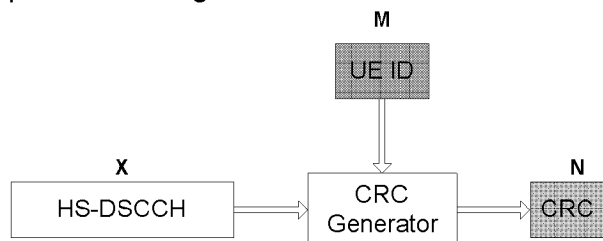
**Alternative 1** - First generate the N bit CRC, independent of UE ID. Then, modulo 2 add the N-bit CRC with the M-bit MAC UE ID. If  $M < N$ , the UE ID is zero padded with  $M-N$  leading 0's or trailing 0's. Here, the CRC is used to provide higher protection for the UE-specific control information carried on HS-DPSCCH. If  $M > N$ , the  $M-N$  least significant bits of the UE ID are truncated prior to the module 2 addition with the CRC field



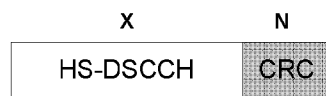
The code multiplexed HS-DSCCH carrying UE specific control information contains embedded UE ID as shown:



**Alternative 2** – In step 2, initialize the CRC generator (i.e., the shift-register) by UE ID value prior to CRC generation for the HS-PDSCCH as shown:



The code multiplexed HS-DSCCH carrying UE specific control information in alternatives 2 contains embedded UE ID as shown:



All three UE-specific CRC approaches have the same error protection capability; proportional to  $2^{-N}$ , where N is the length of the CRC. However, considering the complexity, we propose use of implicit UE identification described as alternative 2, due to the fact that this method does not require assembly and disassembly of UE ID with the HS-DSCCH, at transmitting or receiving end, as required by UE-specific CRC method described in [2].

### 4.0 Performance

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For all the candidates discussed, the error detection protection is on the order of  $2^{-N}$ , where N is the size of the CRC.

## 5.0 Conclusion

Implicit UE ID encoding via a UE-specific CRC is recommended. It is simple, effective, and equally applicable to FDD and TDD.

Three alternative implementations have been discussed, one from reference [2] and two additional alternatives in this contribution.

All will provide the same level of protection, and the least complex version should be selected.

InterDigital's complexity analysis has judged that the simplest, and therefore preferred approach is to initialize the N-stage CRC shift register with N bits from the UE ID.

- [1] TSGR1#21(01) 0745, "Reliability Issues for Downlink Signaling in High Speed Downlink Packet Access (HSDPA)", Motorola
- [2] TSGR1#21(01) 0758, "Comments on the Requirement for UE ID when HI bit is present", Motorola

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