



# Handling Erroneous HARQ data in 802.16j

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## 1. Introduction

In 802.16j TG, several HARQ proposals, that enable extending the HARQ operation to multiple hops, are being discussed. Most notably, proposals 07/185, 07/203, 07/204, 07/232, 07/233, 07/252 and 07/253 deal with the ACK/NAK signaling that is necessary for extending the HARQ operation to multi-hop.

One issue that arises in multi-hop HARQ operation is error handling. What should the RS do if the received HARQ burst is erroneous? Should it forward erroneous burst to the next hop station? In this contribution, we propose that erroneous data can be forwarded, but conditionally. This contribution can be harmonized with (07/252) and can be applied to scenarios involving transparent as well as non-transparent RS operation.

## 2. Discussion

Being able to store erroneous data and combine it with subsequent retransmissions (which themselves may be erroneous) is the very basis of HARQ gain (which is obtained by applying IR or Chase combining). If the RS does not forward (or is not allowed to forward by the specification) erroneous data to the destination, it can be argued that the HARQ gain that can be obtained at the destination is being taken away. By creating a specification which allows the forwarding of erroneous data to the destination, we can re-instate the situation that occurs during single hop and allow the destination to apply creative methods to obtain gain.

Several objections have been raised against forwarding erroneous data, for e.g. how does the destination know that the data is erroneous? The link quality on Source to RS link, may be different from the RS to destination link. Why should the RS use the same MCS level on the transmit link as on the receive link? Perhaps there are other questions too.

If the erroneous data is appended with an additional indication (explicit or implicit) that the data is in error, then both of the above objections can be addressed. There are several ways to embed the information which indicates to the to the next destination (or the next hop station) that the data being relayed is in error

Besides using an extended subheader (for e.g. an Erroneous data indicator (EDI) extended subheader), or using the reserved bit "Rsv(1)" in the generic MAC header, a simple way to ensure that the destination knows that the data is erroneous is to transmit the data burst with an incorrect CRC. The incorrect CRC shall guarantee that the CRC will fail at the receiver and it will know that the data is in error. The procedure could be as follows: When an RS decodes the data burst and detects errors; it can re-encode the erroneous data according to the MCS level

appropriate for transmission on the next hop link. Subsequently, the RS computes the CRC (CRC16 as described in Section ... in 802.16-2005). It then toggles several bits at random locations and intentionally modifies the CRC so that the CRC will fail at the destination (or the next hop).

### 3. Proposed Text Change

*[Insert the proposed text at the end of section 6.3.xx.yy]*

An RS may forward or relay an erroneously decoded HARQ burst to the next hop station. When forwarding an erroneous HARQ burst, the RS may change the modulation and coding level of the received burst. When forwarding an erroneous HARQ burst, and if the RS has applied a different modulation and coding level, the CRC is recomputed and replaced with an erroneous CRC.