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Re:	IEEE 802.16-08/020: "IEEE 802.16 Working Group Letter Ballot Recirc. #28b: Announcement"
Abstract	This contribution proposes remedies to the ambiguities of frame configuration in IEEE802.16j/D3.
Purpose	Discuss and adopt proposed text in TG16j
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Remedies for Frame Configuration in 16j Networks

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Nortel

1. Overview

The objective of this document is to clarify the usage of the RCD message and RS-Config-CMD message, to indicate the TLVs that need to be used by these messages in different stages, and to explain how the zone configuration is done in the 16j based MR networks.

1.1 Discussion on the issues in the current draft

The frame configuration of an RS can be done (a) during network entry, and (b) during operational mode.

1.1.1 During network entry:

During network entry, an RS needs to obtain frame configuration information in two phases.

- First, if the neighborhood measurement needs to be done as specified by the BS in RNG-RSP message, prior to that phase RS needs to know the R-amble location information and neighbor station (RS/BS) information. But RS does not need to know full frame configuration at this stage. Currently the assumption is that this information is obtained from a unicast RCD message. However, RCD message does not provide the neighbor RS information and we need to specify how neighbor information is obtained.
- Second, during configuration phase, it needs to know the zone configuration so that it can switch to listen to relay zone and its R-FCH and R-MAP. Currently, two methods seem to be available to obtain the location of the R-FCH.
    a) By the unicast RCD message: For this configuration information is required to be transmitted in the RCD message. (TLV 11.24.6 in RCD message).
    b) Using MAP IE with DIUC = 13: This method works for 2-hop systems, but if an RS tries to connect to another RS, the first relay zone may not be a transmit zone (hence, it does not know which relay zone contains the R-FCH). If this method is to be used, two bits in DL MAP Gap IE should be used to indicate whether it is a transmit zone or receive zone for more than two hop case.

1.1.2 During Operational Mode:

As per current text frame configuration in operational mode may be done either,

- using RCD (with zone configuration TLV) MAC messages, or
- using R-FCH and R-MAP information on a frame by frame basis

In fact, both methods should contain the same frame structure to avoid confusion; however, due to delay in forwarding frame structure information along the paths, it is not clear which message to follow during the transition period from one configuration to another one (i.e. there may be a conflict between the frame structure information provided by the RCD and that informed by the R-FCH / R-MAP).

In meeting #54, after a meeting with interested members, this was proposed to be informed using a single bit in RCD message. We propose the same here with some additional changes to address several issues described in this document.

RCD Method:

When the RCD method is used, an action time to indicate when the frame configuration is effective for alignment across all the relays in the cell is needed. In addition, it is important that an error recovery mechanism is adopted because these messages are not as strongly error protected as R-FCH is done. Therefore, a retransmission mechanism is needed. If retransmission is needed even for a single RS, this might effect the action time and therefore, the action time should be fixed considering these aspects. All these may add more overhead and delays in making a configuration change. Therefore, this method may be used only for static configuration situations (e.g. static loading situations).

R-FCH Method:

The R-FCH method is more suitable for dynamic zone configuration changes; however, the R-FCH method is not clearly defined in the current text. In addition, if the R-FCH method is used for decentralized scheduling case for more than two hop case, the RSs zone configuration cannot be controlled by the MR-BS; rather, RS should decide its configuration based on the relay configuration of its super-ordinate RSs configuration. This may be useful when independent zoning can be allowed without interference issues. Some example situations are range extension, preplanned RS locations, or multi-carrier systems.

According to the current text, it is mentioned that only MR-BS is to configure (i.e., centralized frame structure control) the TDD frames but as discussed above this needs to be relaxed if R-FCH method is to be used (i.e., a subordinate RS may be allowed to configure its frame configuration on its own depending on the frame configuration of its super ordinate station (only dependency is that an RS should have its DL RX R-zone aligned with its super-ordinate station's TX zone and UL TX R-zone aligned with superordinate station's RX Relay zone). These R-FCH related changes are provide in a separate contribution C80216j-08/108 and are not discussed here further.

Therefore, the objective of this document is to provide a clear configuration process addressing above issues.

Also note that some of the modifications included here were included in the changes proposed in meeting #54 after a joint face-to-face meeting held with interested members.

2. Proposed Remedies

2.1 Clarification on the usage of RCD and RS_Config-CMD messages

Since in the current draft it is not clear how the RCD and RS_Config-CMD messages should be used, the following usage mechanism is proposed to make these two messages serve two different purposes.

Currently, all the information carried by RCD is to inform the RSs the system level operation features and configuration parameters. This is usually per hop information. Therefore, RCD's use should be limited to providing generic information rather than signaling the operational configuration parameters to an RS. Therefore, we propose to use frame configuration TLV in RCD to inform the super-ordinate RSs zone configuration.

On the other hand, the RS_Config-CMD message is to configure the relay with specific functions and parameters and this message can be used by the MR-BS or the super-ordinate station to configure the zone configuration of an RS. R-FCH on the other hand is more appropriate when dynamic configuration changes are required and R-FCH together with the R-MAP would provide zone configuration information of the super-ordinate station.

Therefore, the following clarifications are made for the usage of different mechanisms stated above:

(1) RCD: RCD is sent from a super-ordinate station to an RS to inform the RS the system level information or the superordinate station's configuration which are common to all the RSs directly connected to the superordinate station. This message can be sent unicast to the RS during network entry stage or multicast

to all immediate subordinate RSs during operation stage. The frame configuration TLV contains the MR_BS's or super-ordinate RSs's zone configuration and those parameters will be effective from the action time. This message cannot be used to configure the zones of an RS but RS may be able to configure itself (if such a capability exists).

(2) RS_Config-CMD: This message is sent by the MR-BS or a super ordinate station to configure an RS (activate deactivate functions/features and to set parameters). This message is unicast to the RS during network entry stage in the access zone or during operational stage in the relay zone by the super ordinate station or MR-BS. For this purpose, the frame configuration TLVs should be included into this RS_Config-CMD message, but with a different implication. These TLVs provide the zone configuration that the RS should follow until it is changed by a specific message. Those configurations should be effective from the action time indicated in the message.

(3) R-FCH/R-MAP Usage:

R-FCH provides the location of the next R-FCH and R_MAP and R-MAP provides the zone configuration of the super-ordinate station. This message cannot be used to configure the zones of an RS but RS may be able to configure itself if such a capability exists. See C80216j-08/108 for this mechanism.

(4) How different information provided by different messages is handled by an RS:

Basically, the RS_Config-CMD message should be used whenever MR-BS or super-ordinate RS wants to change the RS configuration. However, the frame structure of the super-ordinate station obtained through RCD or R-FCH/R-MAP should match this information (Receive and transmit zones should match). If the super-ordinate RSs's zone configuration does not match with the RS's zone configuration, the RS shall change its configuration to match these changes by its own if RS is capable of changing its RS configuration on its own. Then it should multicast its new frame structure to the subordinate RSs using RCD or R-FCH and R-MAP.

(5) The TLV for direct relay zone configuration is very similar to the frame configuration TLV and indicates the direct relay zone information. Any update suggested for the frame configuration TLV is directly applicable to this TLV.

2.2 Obtaining Frame Configuration during Initial RS Network Entry Stage

During the initial network entry, after registration phase, if the neighborhood station measurement report is needed, RS needs to obtain the R-amble location and the R-amble monitoring information. R-amble monitoring information can be obtained from the RCD message unicast to the RS in the access zone. Since the location of the R-amble for monitoring is fixed at the end of DL subframe, there is no need to include the Frame Configuration TLV in the RCD message at this stage.

In the RS configuration phase, the RS needs to receive the RCD message with the frame configuration TLV to locate the first transmit relay zone of the superordinate station so that it can listen to relay zone and obtain R-FCH and R-MAP. As mentioned above, the frame configuration TLV in RCD provides the zone configuration of the super-ordinate RS.

Alternatively, MAP IE can be used with DIUC = 13 for this purpose, but this method does not work for more than two hop case (because the first relay zone may not be a transmit zone) and the two reserved bits are proposed to be used for this case if this method is preferred.

Table 1 Part of DL MAP IE with DIUC =13

If DIUC = 13 {		

Relay zone indicator	1 bit	0b0: Normal Gap/PAPR/safety zone 0b1: Relay zone indicator
reserved	2 bits	Shall be zero
}		

This IE is originally intended for MSs to ignore the R-zones. If R-zones are not contiguous in the frame, then we need multiple DL MAP IEs to indicate each zone. Note that the two reserved bits can be used for indicating the transceiver mode of the R-zone.

The RS also receives RS_Config-CMD message with the frame configuration TLV at this stage which indicates the zone configuration that should be followed by the RS. If this TLV is omitted the RS configures its own zone configuration to match the superordinate station configuration. The capability of an RS to configure its own configuration can be exchanged during the capability exchange process.

2.3. Obtaining Frame Configuration during RS Operational Mode

When only MR-BS could control the frame configuration of the RSs, only RS_Config-CMD message should be used for this purpose. The frame configuration TLVs for the RCD message are added to this RS_Config-CMD message for this purpose. In this case, R-FCH and RCD frame configuration information is redundant.

When R-FCH and RCD methods are used without RS-Config-CMD message, the RSs should be allowed to set up their own zone configurations based on its super ordinate station's zoning information.

Whether to continue to follow R-FCH or RCD for zone configuration in the operational mode is determined using a zone configuration control bit in the RCD message..

2.4 R-FCH/R-MAP and Remedies

These remedies are provided in a separate contribution. See C80216j-08/108.

3 Required Text Changes

[Change the first paragraph of Subclause 6.3.2.3.65 as indicated]

This message shall be transmitted by an MR-BS or an RS to all subordinate RSs in the next hop using a ~~fragmentable broadcast~~ multicast CID or to an RS on the RS's primary management CID. The message is used for network entry during the neighborhood measurement procedure or the configuration procedure. If the received message is received on the primary management CID, the RS shall respond with the MR_Generic-ACK message. The frame configuration TLVs (11.24.6 and 11.24.7) in this message indicate the frame usage at the MR-BS/RS that transmits this message.

Syntax	Size	Note
RCD_Message_Format(){	-	
Management Message Type = 70	8 bits	
If (CID in MAC header is ~~fragmentable broadcast~~ multicast CID){	-	

RCD configuration change count	16 bits	
} else { - -	-	
Transaction ID	16 bits	
}	-	
Frame Number Action	8 bits	8-bit LSBs of the frame number
TLV Encoded Information	variable	TLV Specific
}		

[Insert the following text to Line 12 of Page 40 in Subclause 6.3.2.3.65]

The RCD message may include the following TLVs for multiple frame configuration:

Frame_Config_Flag (See 11.24.9)

[In Subclause 6.3.2.3.69, insert the following text in Line 31 of Page 50]

The RS Config CMD message may include the following TLVs for frame configuration:

DL subframe configuration (see 11.24.6)

UL subframe configuration (see 11.24.6)

The RS Config CMD message may include the following TLVs for Direct Relay Zone configuration:

Direct Relay Zone configuration (see 11.24.7)

[Insert the following text to Line 27 of Page 105 in Subclause 6.3.9.16 as indicated]

The MR-BS may request the RS to do neighbor measurements during network entry or re-entry using the RS network entry optimization TLV in the RNG-RSP message. If a measurement is requested, MR-BS may send a MR NBR INFO message to the RS to simplify neighborhood discovery.

6.3.9.18.1 Parameter configuration

[Insert the following in Line 59 of Page 106 in Subclause 6.3.9.18.1]

Frame configuration during operational mode may be done either in a static manner using RCD and RS Config CMD MAC messages (See 6.3.2.3.65 and 6.3.2.3.69), or in a dynamic manner using R-FCH (See 8.4.4.7.4). If a frame configuration TLV is not received in the RS Config CMD message, the RS may decide on its own frame configuration based on its superordinate station's frame configuration. The Frame Config_Flag TLV in RCD message may be transmitted to indicate which mechanism to be followed for determining frame structure in the upcoming frame(s).

[Change Subclause8.4.4.7.4 as indicated]

8.4.4.7.4 R-Zone prefix

The R-Zone_Prefix is a data structure transmitted on R-FCH of a DL relay zone. The R-Zone_Prefix

includes information regarding the location of the first transmit relay zone in the next frame that contains a transmit relay zone and the information required for decoding R-MAP. In the case that RCD message contains the Frame_Config_Flag set to 1, the frame configuration TLVs in the RCD message shall be followed to locate the relay zones in the future frames. Otherwise, the R-FCH/R-MAP shall be used to determine the frame configuration parameters. Table 377a defines the format of the R-Zone_Prefix for FFT sizes other than 128 and Table 377b defined the format for a FFT size of 128.

[Change Lines 6 and 25 on Page 200 (2 Rows of Table 380 as indicated]

~~reserved~~Transceiver_mode	2 bits	~~Shall be zero~~ 0b00: tx mode, 0b01: rx mode 0b10: idle mode 0b11: reserved

[Insert the following text at the end of Table 380]

Transceiver mode

Transceiver mode in the relay zone is one of either Tx mode (00), Rx mode (01), or Idle mode (10). When the transceiver mode is idle mode, it does not transmit nor receive.

[Insert the following text to Subclause 11.24]

11.24.9 Frame Config_Flag

If this field is set to 1, it indicates that the RS shall use the RCD message to obtain frame configuration. If it is set to 0, R-FCH/R-MAP messages shall be used for determining the frame structure.

+++++++++End of text changes+++++++++++++++

Appendix: More details on the use of RCD message

In the current text, RCD message function is not clear. While some TLVs, such as Frame Configuration TLV, may be interpreted as configuration commands for the subordinate RSs, some other TLV, such as R-amble transmission pattern, indicates the system-wide descriptions or parameters. If the RCD is to configure the subordinate RSs this may not work. See for example Figure 1. The subordinate RSs of MR-BS/RS may have different requirements. RS 12 requires an R-zone to transmit to its subordinate RSs, during which period RS 11 can transmit to MSs in an access zone. However, there is already RS config CMD message that is intended for configuring the operational parameters of an RS. Thus, the RCD message should indicate the parameters of the station transmitting the RCD message. With regard to frame configuration, depending on the system load or interference levels, it may be sufficient to provide the RS with the frame structure of its super ordinate station. If it is not sufficient, its frame can be configured by the MR-BS or its super-ordinate RS using RS_Config-CMD message.

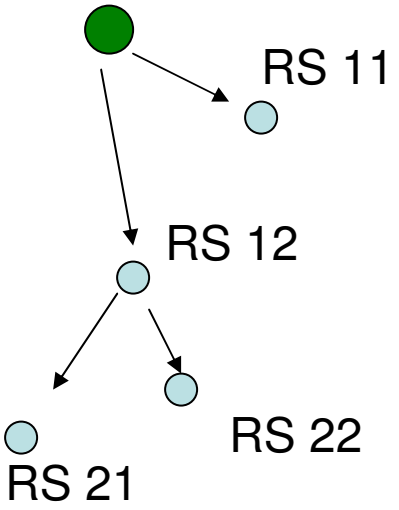

Figure 1 A simple network topology. RS 11 does not need to transmit R-FCH/R-MAP while RS 12 does. The frame configuration for RS 11 and RS 12 can be different.