Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Proposal for PHY Control Channels for Interference Mitigation in IEEE 802.16m**
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Re:	IEEE 802.16m-08/016r1: Call for Contributions on Project 802.16m System Description Document (SDD). Target topic: "Interference Mitigation'.
Abstract	This contribution proposes for PHY Control Channels for Interference Mitigation
Purpose	To be discussed and adopted by TGm for the 802.16m SDD.
Notice	
Release	
Patent Policy	

Proposal for PHY Control Channels for Interference Mitigation in IEEE 802.16m

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1. Introduction

In wireless communication it incurs many types of interferences. The interferences can be classified into three classes as interference between BS and MS, between MSs and between BSs. For the Interference Mitigation we define several DL/UL control channels in the IEEE 802.16m and from the control information conveyed between the BS and MS so as to initiate the Interference Mitigation process to reduce the possible interference effect in the data transmission between the MS and BS.

2. Frame Structure for Control Channels

2.1 Type A Frame Structure for Control Channels

Type A frame structure for control channels has the structure as shown in Fig. 1. Its DL control flow is shown in Fig. 2. There are six types of control channels in the frame as described in the following:

2.1.1 Super Frame Header (SFM): The SFH is used for the transmission of the information such as the synchronization, frequency reference, cell ID etc.

2.1.2 Frame Header (FH): The FH identifies which frame should activate an interference reducing zone (IR-Zone), and when an IR- Zone is activated then the MS in this region will receive the interference reducing service.

2.1.3 Frame Map (FM): This FM is used to designate MSs' locations in the sub-frame for those MSs are in the interference-reducing region.

2.1.4 Sub-frame Map (SFM): The SFM is used to designate which MSs in this IR-Zone need the interference reducing service. The MS designated can be a group of MSs or a single MS. It gives MS the information it is in the interference reducing zone, the proper pilot pattern and it also provides the relative location information of the MS request UL- Zone.

2.1.5 Interference Reducing Zone (IR-Zone): This zone is activated by the BS it can be divided into UL and DL IR-Zones. The zone's size and location are described in the FH and the SFM it also serves those MSs that need interference reducing services.

2.1.6 Uplink–interference Reducing Request (UL-IRR): the MS will send an interference reducing request in this frame and the BS will include this MS which sends this request in the IR-Zone in the next DL frame.
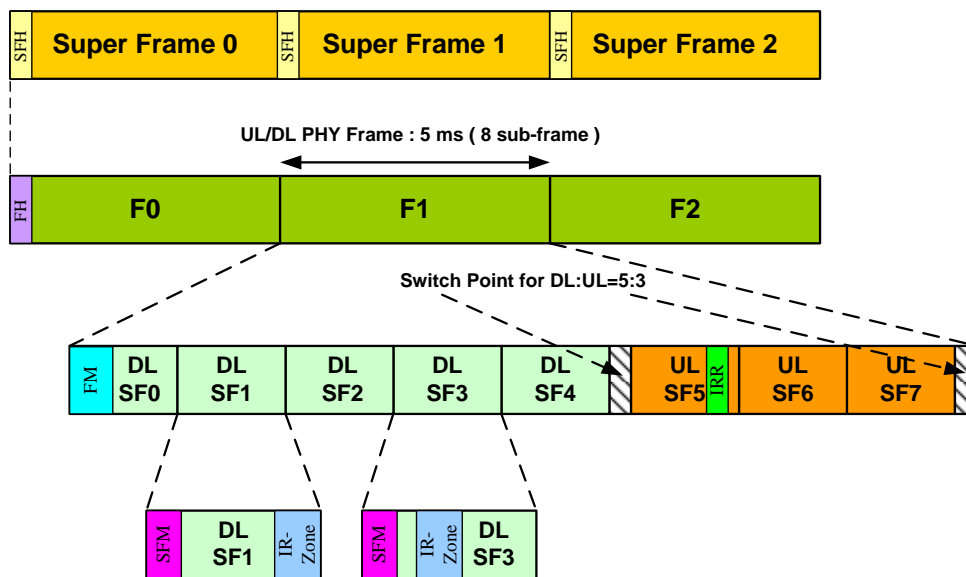
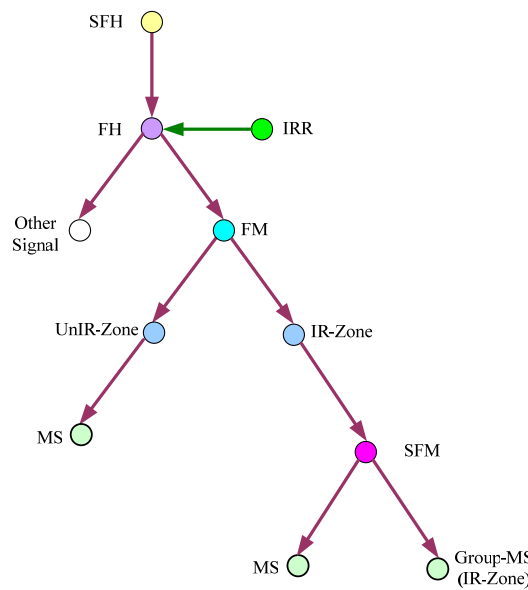Fig. 1 Type A Frame Structure for Control Channels (TDM Mode)

Fig. 2 Type A DL Control Flow for Interference Mitigation

2.2 Type B frame structure for control channels

Type B frame structure for control channels has the structure as shown in Fig. 3. Its DL control flow is shown in Fig. 4. There are five types of control channels in the frame and described in the following:

2.2.1 Super Frame Header (SFH): The SFH is used for the transmission of the information such as the synchronization, frequency reference, cell ID etc.

2.2.2 Frame Header (FH): The FH identifies which frame should activate an interference reducing region (IR-Region), and when an IR- Region is activated then the MS in this region will receive the interference

reducing service.

2.2.3. Frame Map (FM): The FM is used to designate which MSs in this IR-Region need the interference reducing service. The MS designated can be a group of MSs or a single MS. It gives MS the information of the region location, the proper pilot pattern and it also will provide the relative location information of the UL-Region.

2.2.4 Sub-frame Map (SFM): The SFM is used to designate which MSs in this IR-Region need the interference reducing service. The MS designated can be a group of MSs or a single MS. It gives MS the information it is in the interference reducing region, the proper pilot pattern and it also provides the relative location information of the MS request UL- Region.

2.2.5 Interference Reducing Region (IR-Zone): This zone is activated by the BS it can be divided into UL and DL IR-Zones. The zone's size and location are described in the FH, it also serves those MSs that need interference reducing services.

2.2.6 Uplink–interference Reducing Request (UL-IRR): the MS will send an interference reducing request in this frame and the BS will include this MS which sends this request in the IR-Region in the next DL frame.
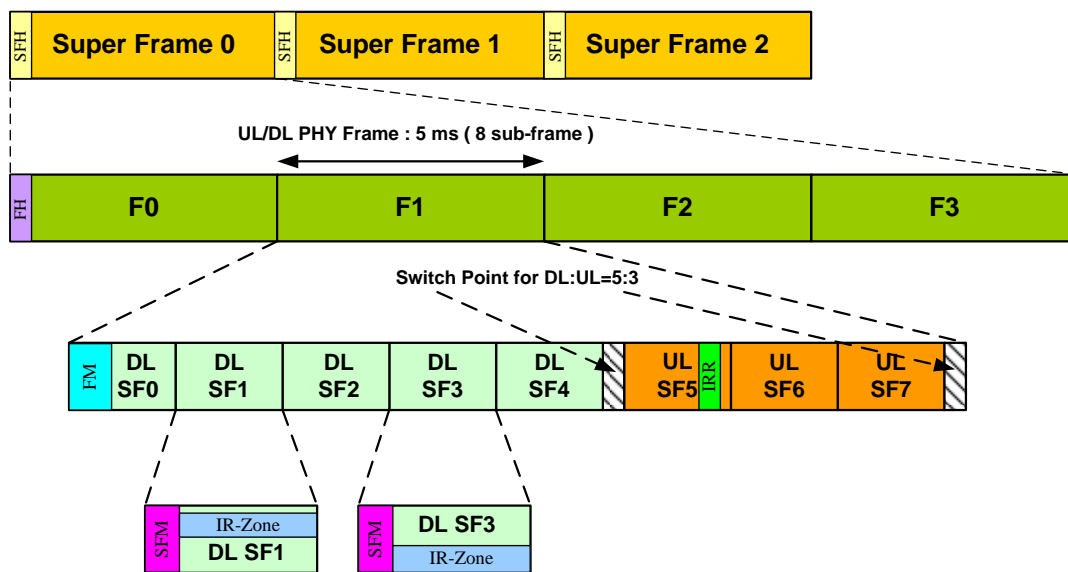

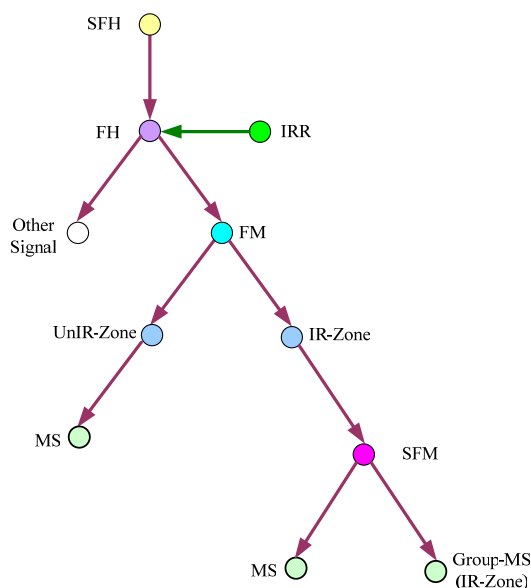Fig. 3 Type B Frame Structure for Control Channels (FDM Mode)

Fig. 4 Type B DL Control Flow for Interference Mitigation

2.3 Type C frame structure for control channels

Type C frame structure for control channels has the structure as shown in Fig. 5. Its DL control flow is shown in Fig. 6. There are five types of control channels in the frame and described in the following:

2.3.1 Super Frame Header (SFH): The SFH is used for the transmission of the information such as the synchronization, frequency reference, cell ID etc.

2.3.2 Frame Header (FH): The FH identifies which frame should activate an interference reducing zone (IR-Region), and when an IR- Region is activated then the MS in this region will receive the interference reducing service.

2.3.3. FM (Frame Map): This FM is used to designate MSs' locations in the sub-frame for those MSs are in the interference-reducing zone (IR-Zone).And the FM is used to designate which MSs in this IR-Zone need the interference reducing service. The MS designated can be a group of MSs or a single MS. It gives MS the information of the zone location, the proper pilot pattern and it also will provide the relative location information of the UL-Region.

2.3.4 Interference Reducing Zone (IR-Zone): This zone is activated by the BS it can be divided into UL and DL IR-Zones. The Zone's size and location are described in the FH it also serves those MSs that need interference reducing services.

2.3.5 Uplink–interference Reducing Request (UL-IRR): the MS will send an interference reducing request in this frame and the BS will include this MS which sends this request in the IR-Region in the next DL frame.
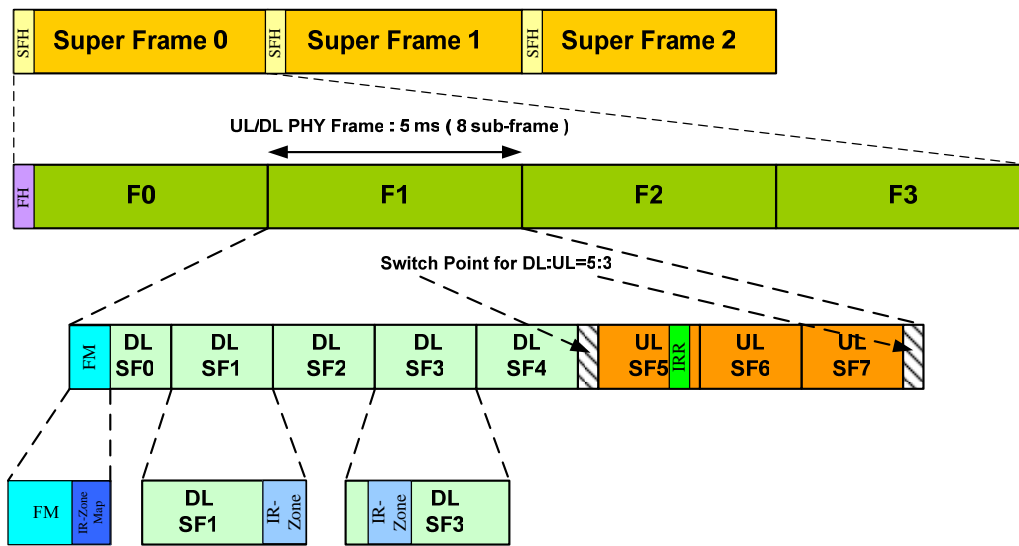
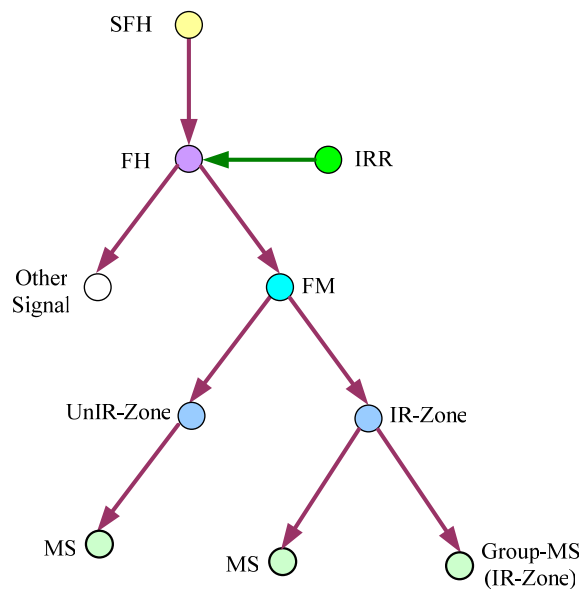Fig. 5 Type C Frame Structure for Control Channels (TDM Mode)

Fig. 6 Type C DL Control Flow for Interference Mitigation

2.4 Type D frame structure for control channels

Type D frame structure for control channels has the structure as shown in Fig. 7. Its DL control flow is shown in Fig. 6. There are five types of control channels in the frame and described in the following:

2.4.1 Super Frame Header (SFH): The SFH is used for the transmission of the information such as the synchronization, frequency reference, cell ID etc.

2.4.2 FH (Frame Header): the FH will identify which frame should activate an IR- Region (interference reducing Region), and when an IR- Region is activated then the MS in this zone will receive the interference reducing service.

2.4.3 FM (Frame Map): This FM is used to designate MSs' locations in the sub-frame for those MSs are in the interference-reducing zone (IR-Region). And the FM is used to designate which MSs in this IR-Region need the

interference reducing service. The MS designated can be a group of MSs or a single MS. It gives MS the information of the region location, the proper pilot pattern and it also will provide the relative location information of the UL- Region.

2.4.4 Interference Reducing Region (IR-Zone): This zone is activated by the BS it can be divided into UL and DL IR-Zones. The zone's size and location are described in the FH it also serves those MSs that need interference reducing services.

2.4.5 Uplink–interference Reducing Request (UL-IRR): the MS will send an interference reducing request in this frame and the BS will include this MS which sends this request in the IR-Region in the next DL frame.
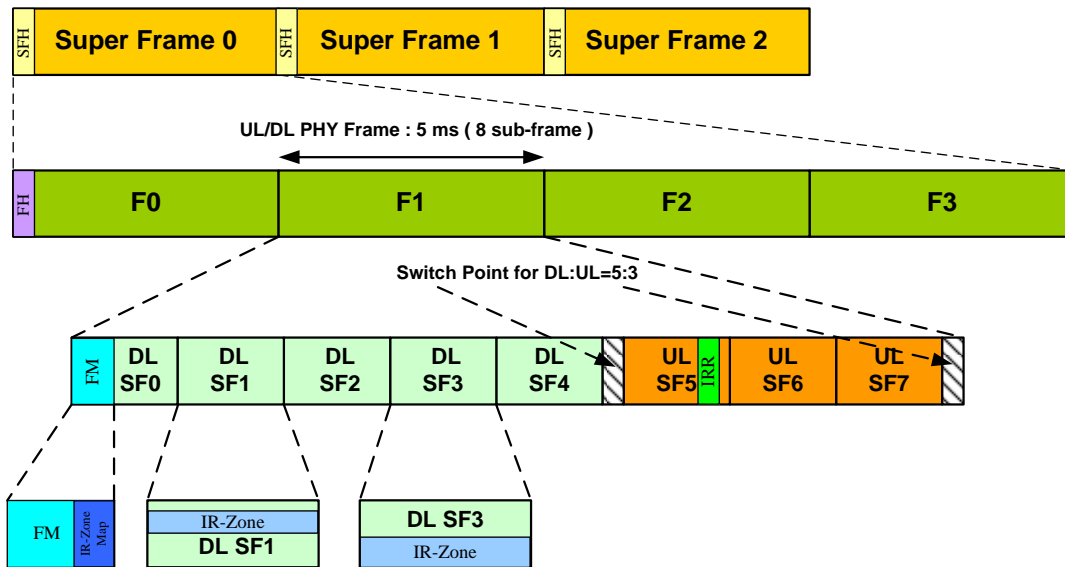
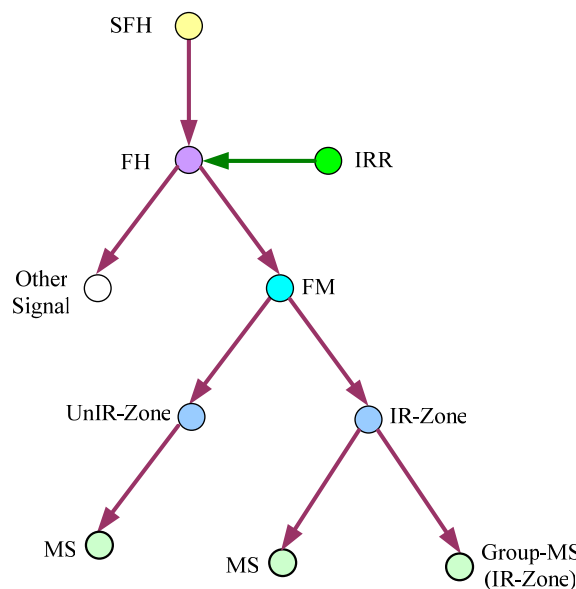Fig. 7 Type D Frame Structure for Control Channels (FDM Mode)

Fig. 8 Type D DL control flow for Interference Mitigation

3. Conclusion
With the IR-Zone concept introduced it will provide the interference reducing pilot patterns to the MSs through

the UL/DL control channels to reduce the possible MSs' interference levels. When an MS's interference level is high it will transmit an interference reducing request (IRR) to its serving BS, and when this BS receives this request it will check with other BSs and sends an IR-Zone notification and provides an interference reducing pilot pattern in the next frame for the MS to use in its later transmission. Consequently with the IR-Zone design concept it will reduce the interference level.

4. References

[1] IEEE 802.16m System Requirements, IEEE 802.16m-07/002r4.
[2] The Draft IEEE 802.16m System Description Document, IEEE 802.16m-08/003r3
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Text Proposal for the 'Interference Mitigation'

==================*Start of Proposed Text*=========================

XXX. PHY Control Channels for Interference Mitigation

The BS may coordinate with neighboring BSs to reduce interference at the cell edge by configuring IR-Zone and sending interference reducing pilot patterns within the zone. The IR-Zone may be configured by the BS in an unsolicited manner or may be requested by the MS. The IR-Zone is configured in either TDM or FDM across one or more subframes.

There are six types of control channels in the frame and described in the following:

- **Super Frame Header (SFH):** The SFH is used for the transmission of the information such as the synchronization, frequency reference, cell ID etc.
- **Frame Header (FH):** The FH identifies which frame should activate an interference reducing zone (IR-Region), and when an IR- Region is activated then the MS in this region will receive the interference reducing service.
- **FM (Frame Map):** This FM is used to designate MSs' locations in the sub-frame for those MSs are in the interference-reducing zone (IR-Zone).And the FM is used to designate which MSs in this IR-Zone need the interference reducing service. The MS designated can be a group of MSs or a single MS. It gives MS the information of the zone location, the proper pilot pattern and it also will provide the relative location information of the UL-Region.
- **Sub-frame Map (SFM):** The SFM is used to designate which MSs in this IR-Zone need the interference reducing service. The MS designated can be a group of MSs or a single MS. It gives MS the information it is in the interference reducing zone, the proper pilot pattern and it also provides the relative location information of the MS request UL- Zone.
- **Interference Reducing Zone (IR-Zone):** This zone is activated by the BS it can be divided into UL and DL IR-Zones. The Zone's size and location are described in the FH it also serves those MSs that need interference reducing services.
- **Uplink–interference Reducing Request (UL-IRR):** the MS will send an interference reducing request in this frame and the BS will include this MS which sends this request in the IR-Region in the next DL frame.

Four examples of the frame structure with IR-Zone are depicted in the following figures with their associated DL control flows.
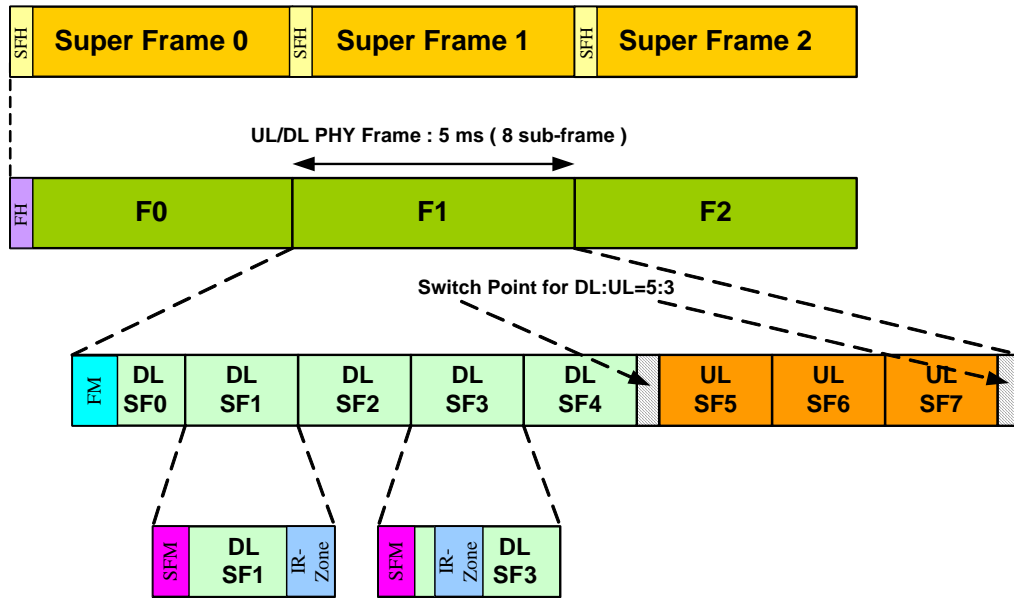

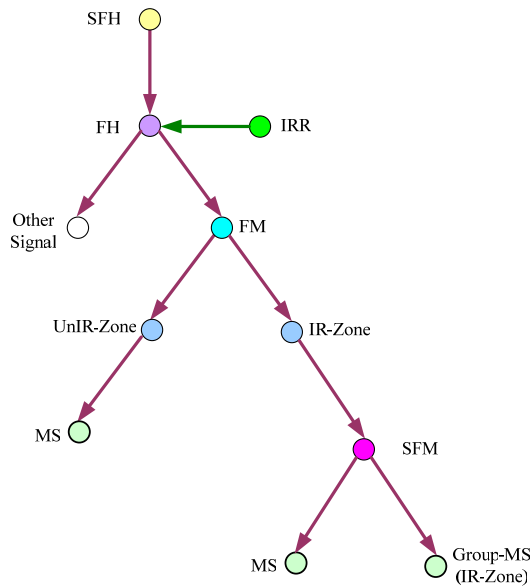*Fig.X.1 Type A Frame Structure for Control Channels (TDM Mode)*

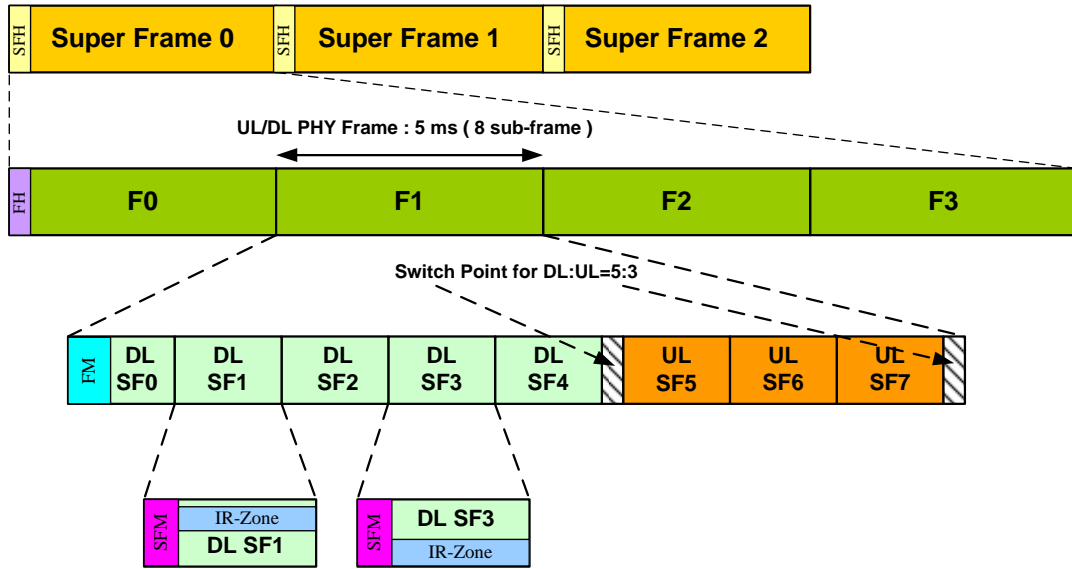*Fig.X.2 Type A DL Control Flow for Interference Mitigation*

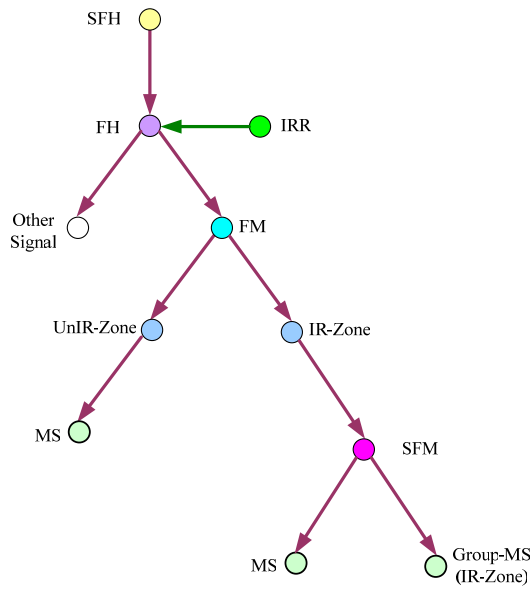*Fig.X.3 Type B Frame Structure for Control Channels (FDM Mode)*

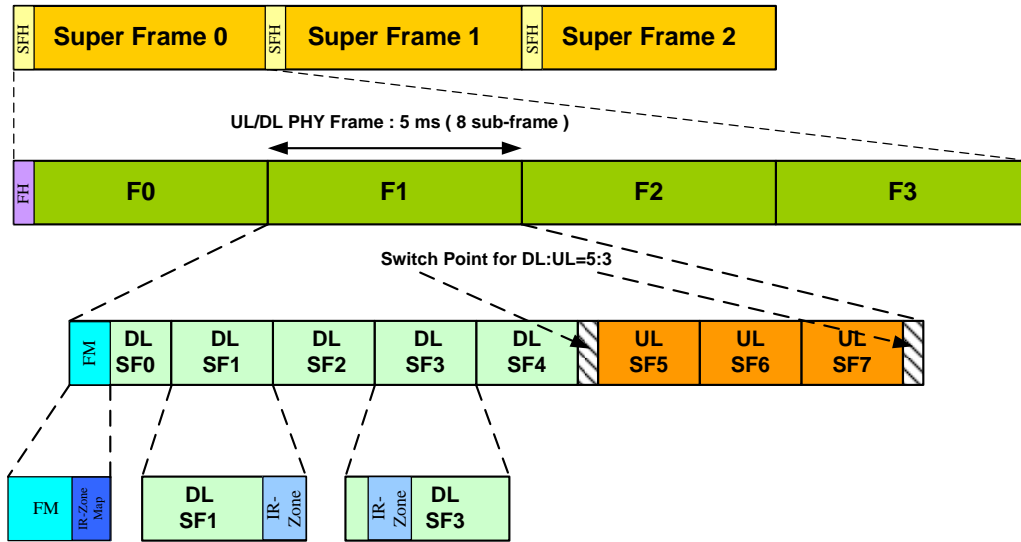*Fig.X.4 Type B DL Control Flow for Interference Mitigation*

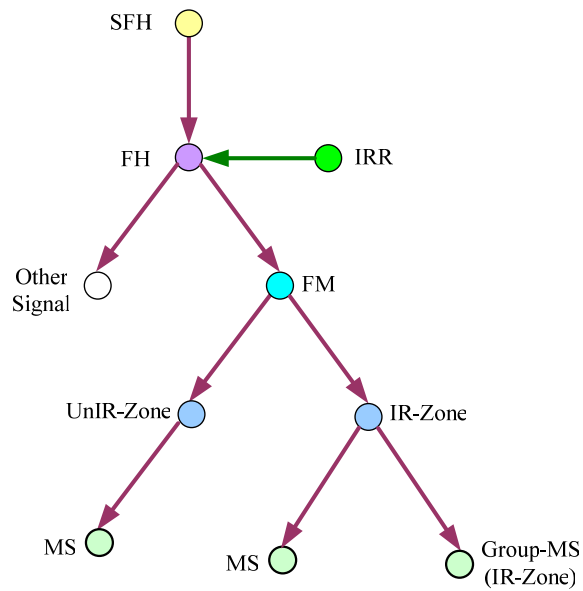*Fig.X.5 Type C Frame Structure for Control Channels (TDM Mode)*

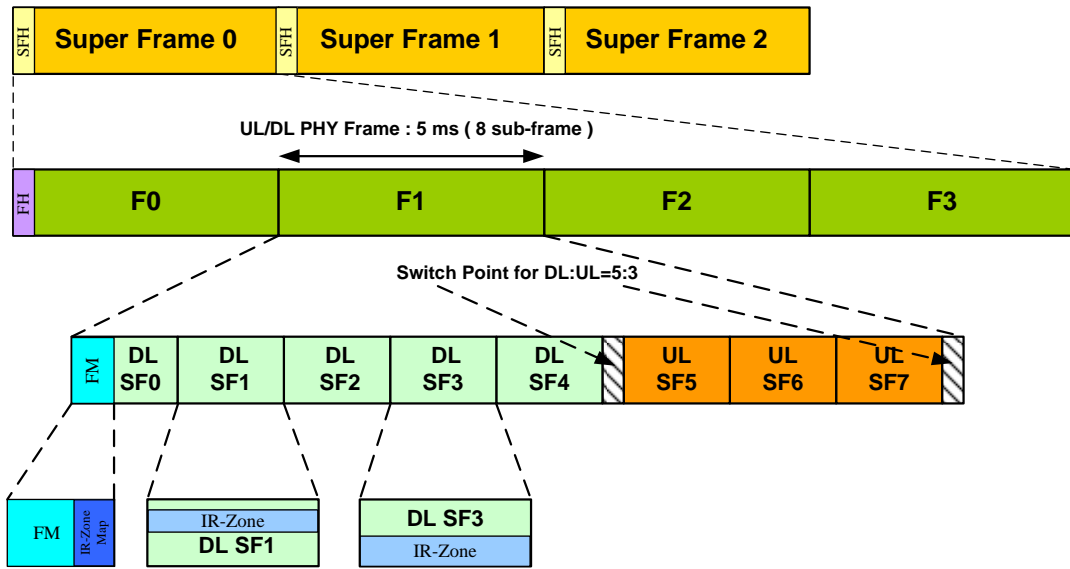*Fig.X.6 Type C DL Control Flow for Interference Mitigation*

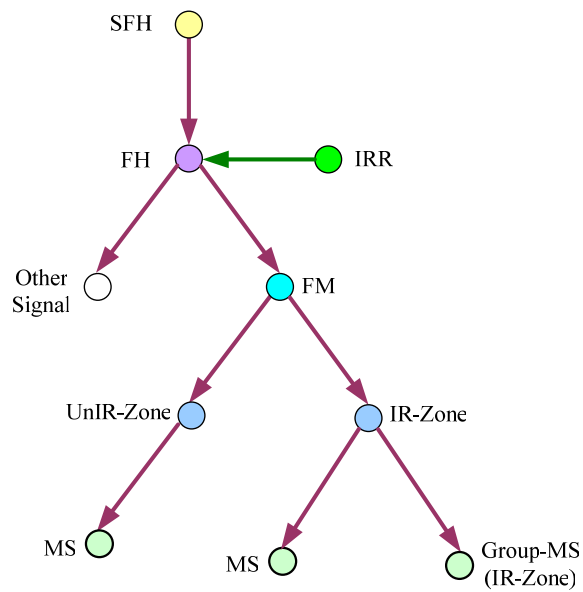*Fig.X.7 Type D Frame Structure for Control Channels (FDM Mode)*

Fig.X.8 Type D DL Control Flow for Interference Mitigation

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