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Re:	IEEE 802.16m-08/016r1: Call for Contributions on Project 802.16m System Description Document (SDD). Target topic: “Uplink Control Structures”.
Abstract	This contribution proposes inter-cell interference management in DL/UL control
Purpose	For discussion and approval by TGm.
Notice	
Release	
Patent Policy	

Inter-Cell Interference Management DL/UL Control

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1. Introduction

In this contribution we propose some interference management measures in the PHY Control to reduce the possible interference in the transmission between an MS and BSs. The interference can be roughly classified into two categories: 1) location-oriented interference: it further can be divided into two types of interferences, the cell edge interference and the sector interference. In the cell edge interference, an MS located in a cell edge zone suffers interference from several BSs. In the sector interference, an MS suffers interference from different sectors on the same BS. 2) Cross link interference in TDD/FDD: the interference generated from data transmissions between various down kinks and up links and when the data transmissions are in the transition between DL and UL. In order to reduce various kinds of interference we introduce the interference reducing pilots and assign interference weight for every pilot type. Then in communication paths between an MS and various BSs that it includes a desired path between the MS and the desired BS and many interference paths between the MS and other BSs, and when we assign various interference weight pilot types to the BSs, the resulting interference will be lower comparing with the interference induced in the system by using the conventional common interference weight pilot for all BSs. The Protocol Structure for IEEE 802.16m is shown in Fig.1.

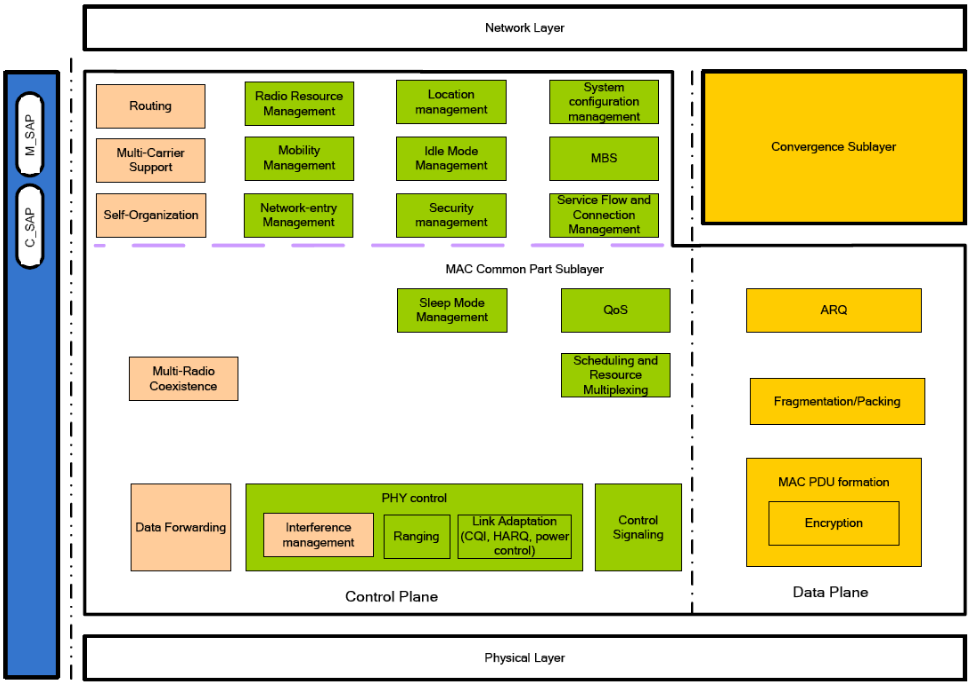


Fig. 1 The IEEE 802.16m Protocol Structure

2. *Interference Types*

In general interferences can be divided into two classes, namely, 1) Location-oriented interference: the interference is generated when the MS is located at the cell edge or at the sector edge and 2) Link-oriented interference: the interference is generated between MS and BS when data is transmitted both in the DL and UL.

2.1 Interference Generated Due to the MS Location

2.1.1 MS located in the cell edge zone

As shown in Fig. 2, when the MS is located in the cell edge its received signal level, due to the near-far effect, from the serving BS may be lower than the interferences generating from other BSs.

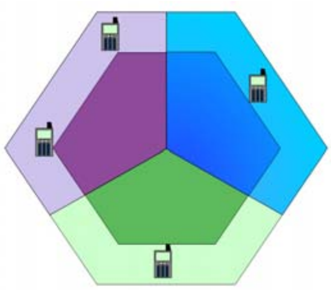


Fig. 2 Location-oriented interference: MS in the cell edge zone

2.1.2 MS located at sector boundary

As shown in Fig. 3, when the MS is located at the sector edge it will suffer interferences generating from other sectors besides the signal from the serving sector.

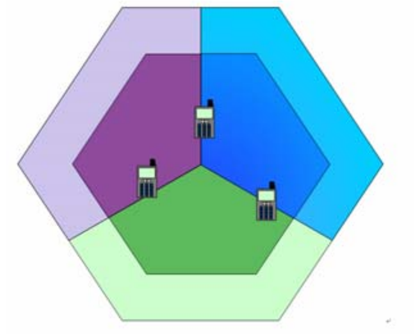


Fig. 3 Location-oriented interference: MS at the sector boundary

2.2 Interference between BS and MS or between MS and MS

2.2.1 Data Transition Interference in TDD

In Fig.4 it depicts the interference generated when data is transmitted in the TDD mode. When different MSs are in the same sector and transmitting and receiving data simultaneously in the UL and DL in TDD mode, they may suffer the data transition interference when those MSs are in the time transition interval.

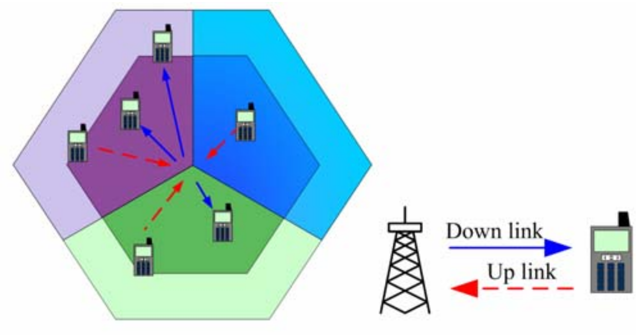


Fig. 4 Data Transition Interference in TDD

2.2.2 Data transition interference in FDD

In Fig.5 it depicts the interference generated when data is transmitted in the FDD mode. When different MSs are in the same sector and transmitting and receiving data simultaneously in the UL and DL in the FDD mode, they may suffer the data transition interference when those MSs are in the frequency transition interval.

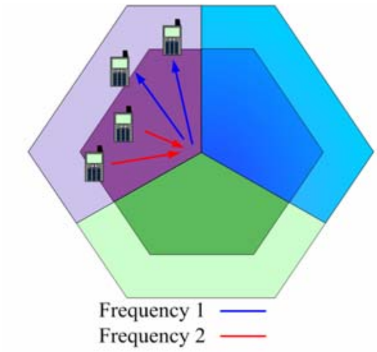


Fig. 5 Data Transition Interference in FDD

3. PHY Control for Interference Management

Based on the interferences as introduced in section 2, we will define in this section some interference management methods in the DL/UL control channel so as to reduce the interferences in the data transmission between an MS and a BS.

3.1 Frame Structure for Control Channel

The general control channel structure for 802.16m is shown in Fig. 6. There are six types of control channels:

1) **SFH (Super Frame Header)**: the SFH is used for the transmission of the information such as the synchronization, frequency reference, cell ID etc
2) **FH (Frame Header)**: the FH will identify which frame should activate an IR-Zone (interference reducing zone), and when an IR-Zone is activated then the MS in this zone will receive the interference reducing service.
3) **FM (Frame Map)**: This FM is used to designate MSs locations in the sub-frame for those MSs are not in the interference-reducing zone (IR-Zone).
4) **SFM (Sub-frame Map)**: 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 of the zone location, the orthogonal pilot pattern and it also will provide the relative location information of the UL- Zone.
5) **IR-Zone (Interference Reducing 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.
6) **UL-IRR (Uplink–interference Reducing Request)**: 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.

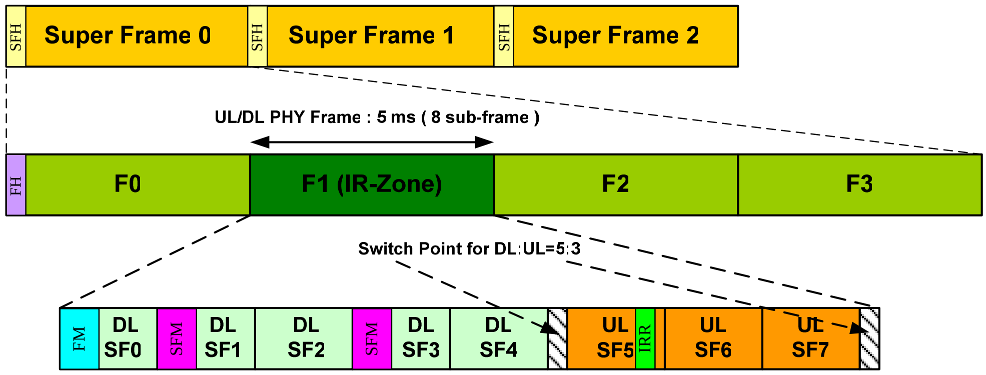


Fig. 6 (a) Control channel structure for TDD

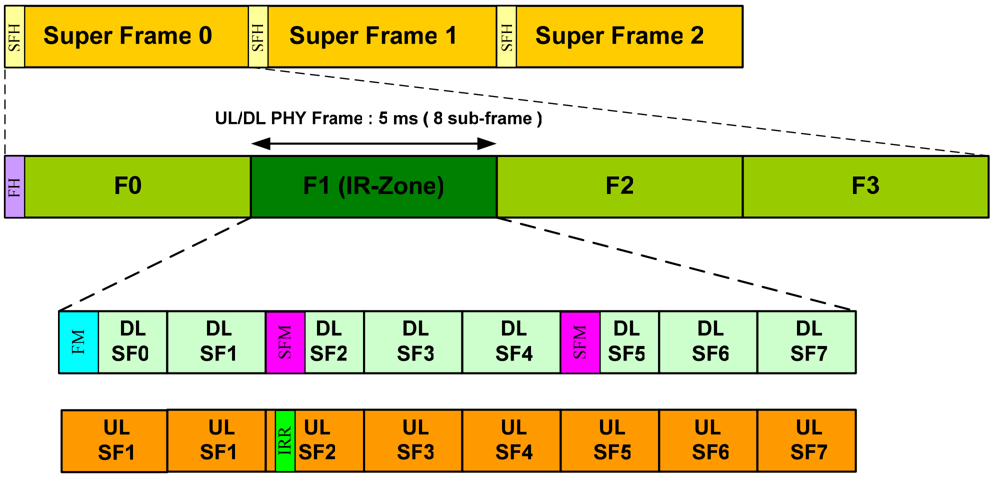
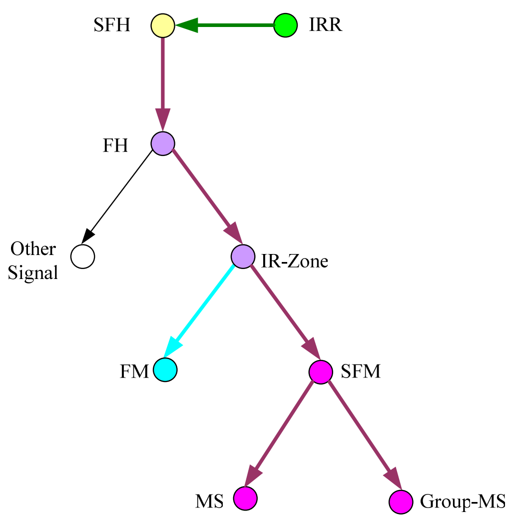


Fig. 6 (b) Control channel structure for FDD

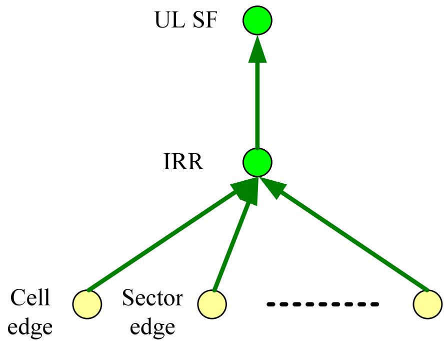
3.1.1 DL control flow for interference management

The downlink message or information conveyed from the superframe to the subfarame as described in the above control channel can be described schematically in the following flow diagram.



3.1.2 UL control flow for interference management

The uplink control flow of the MS sending the Interference reducing request (IRR) to the BS as described in the above control channel can be described schematically in the following flow diagram.



3.2 DL/UL Control Channel for Inference Management

Some extra message/information is included in the conventional DL and UL control channels. As shown in Fig. 7 we include some interference management information in the DL control channel. In the DL control channel, the super frame header contains the system information elements such as the frequency reference, cell ID, system bandwidth, CP length…etc. In frame header it contains the DL and UL parameters that to locate the user's position and to identify if it is in the IR-Zone.

For MS locating in this IR-Zone, the MS can be an MS in a group or a unique MS. When this zone exists, it contains a specific Sub-Frame Header. In this SFH it contains the information of SFM, and it also provides the location information of the MS, which has been accepted this kind of service, and the pilot pattern for the MS to use in the interference reducing management. Cell management information is also included in the UL control signal, as shown in Fig. 8, when the MS is in the IR-zone it will add an IRR signal in the UL control subframe. When BS receives this IRR signal it will add this MS in its designated IRR zone in the next frame and then the BS will determine from this IRR the pilot structure will be used in its data transmission.

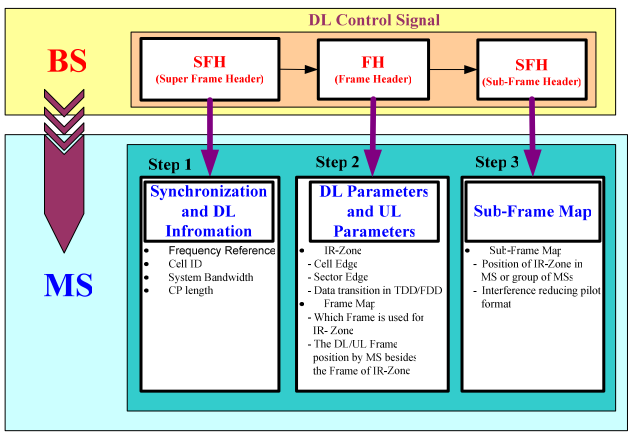


Fig. 7 Cell Management Information in the DL control Channel

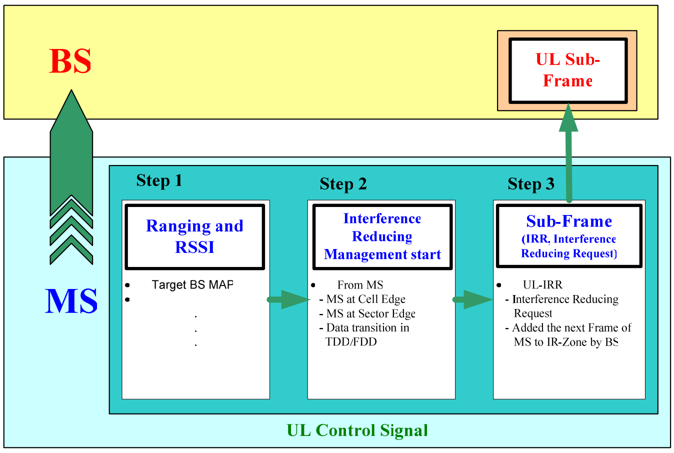


Fig. 8 Cell Management Information in the UL control

1) Example of assigning cell edge user to proper subframe in an IR –Zone frame
As shown for example in Fig. 9, it assumes that cell 1 and cell 2 occupy the same frequency band. When an MS is in the cell edge (Zone B) of cell 1 it will suffer the interference from cell 2, similarly the MS in the cell 2 edge, Zone B, it will have interference generated from cell 1. In this situation when the MS transmits an IRR request, this IRR request will be added into the IR-Zone in the next frame and it will use a pilot pattern that is orthogonal to or has minimum interference to the pilot pattern used in cell 2. For example in Fig. 9 if the MS in SF7 has the IRR signal added and send an IRR request to cell1 1 then cell 1 in the next frame will add this MS in the IR-Zone, SF1 or SF2. Then in Fig. 10 this MS is in the IR-Zone the SFM will indicate the location of this MS in the IR-Zone and also provides its pilot pattern, while an MS not in the IR-Zone, it will be controlled by the Frame MAP.

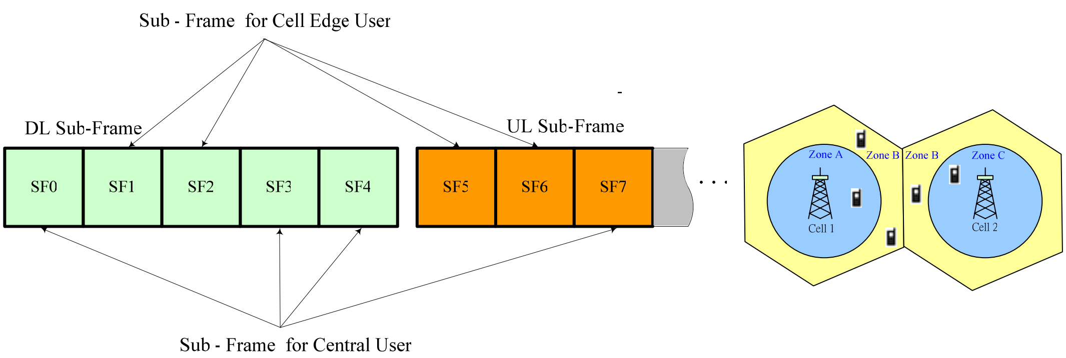


Fig. 9 Different sub-frames are allocated for users with different levels of interferences

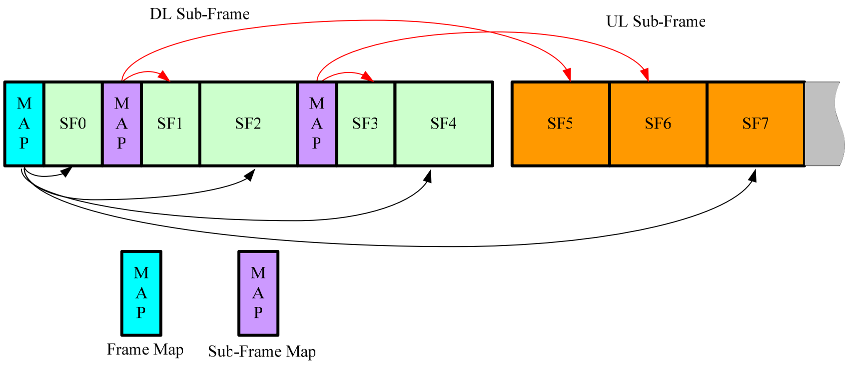


Fig 10. MAP to define cell edge user and central edge user

4. *Example for Interference Reducing Pilot*

Several examples will be given in this section to illustrate how the MS sends the IRR request signal and how the BS adds this MS in the IR-Zone and then how to assign pilot pattern for the MS already existing in the IR-Zone.

4.1 Two Types of Interference Reducing Pilots

1) Square Type Pilot

The square type pilot, as shown in Fig. 11 in gray, consisting of four pilots in the square is the basic constituent block for the 18x6 resource block consisting of 18 subcarriers and 6 symbols.

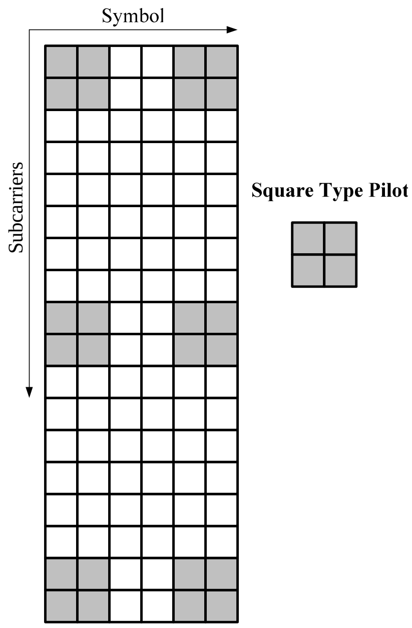


Fig. 11 Square Type Pilot

2) Line Type Pilot

The line type pilot, as shown in Fig. 12 in gray, consisting of four pilots in a line is the basic constituent block for the12x6 resource block consisting of 12 subcarriers and 6 symbols.

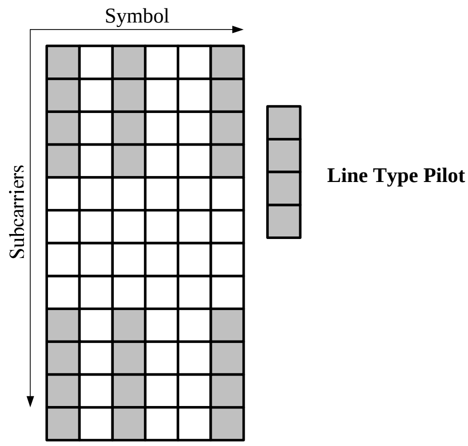


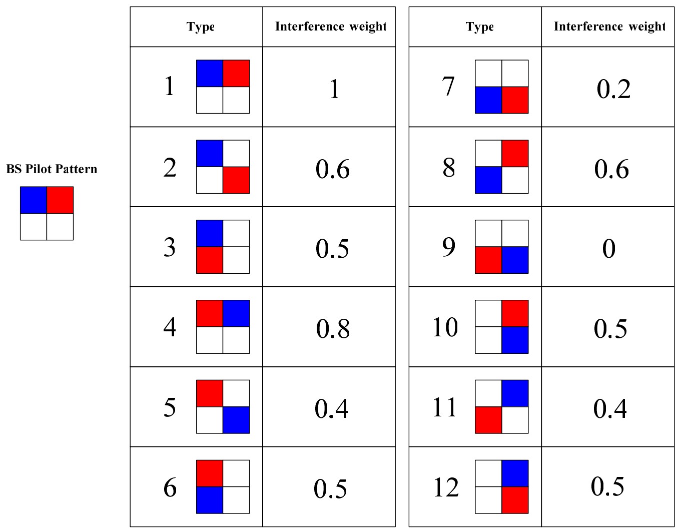
Fig. 12 Line Type Pilot

4.2 Interference Reducing Pilot Pattern vs. Interference weight

With the two types of pilot patterns considered as defined in section 4.1, we will then illustrate in this section how to assign interference weight for every type of pilot.

4.2.1 Square Type Pilot

For square type pilot the interference weight assignment for various types of pilot pattern are shown in Fig.13-A and the resulting interference weight between an MS and a BS assigned for every possible pair of square type pilot are shown in Table 1-A.



Type	Interference weight	Type	Interference weight
1	1	7	0.2
2	0.6	8	0.6
3	0.5	9	0
4	0.8	10	0.5
5	0.4	11	0.4
6	0.5	12	0.5

Fig. 13-A Interference weight assignment for square type pilot pattern

Table 1-A Resulting interference weight between two pilot types from square type pilot assigned for an MS and a BS

IR Pilot_MT / Pilot_BS	1	2	3	4	5	6	7	8	9	10	11	12
1	1	0.6	0.5	0.8	0.4	0.5	0.2	0.6	0	0.5	0.4	0.5
2	0.6	1	0.5	0.4	0.8	0.5	0.6	0.2	0.4	0.5	0	0.5
3	0.5	0.5	1	0.5	0.5	1	0.5	0.5	0.5	0	0.5	0
4	0.8	0.4	0.5	1	0.6	0.5	0	0.4	0.2	0.5	0.6	0.5
5	0.4	0.8	0.5	0.6	1	0.5	0.4	0	0.6	0.5	0.2	0.5
6	0.5	0.5	1	0.5	0.5	1	0.5	0.5	0.5	0	0.5	0
7	0.2	0.6	0.5	0	0.4	0.5	1	0.6	0	0.5	0.4	0.5
8	0.6	0.2	0.5	0.4	0	0.5	0.6	1	0.4	0.5	0.8	0.5
9	0	0.4	0.5	0.2	0.6	0.5	0	0.4	1	0.5	0.6	0.5
10	0.5	0.5	0	0.5	0.5	0	0.5	0.5	0.5	1	0.5	0.8
11	0.4	0	0.5	0.6	0.2	0.5	0.4	0.8	0.6	0.5	1	0.5
12	0.5	0.5	0	0.5	0.5	0	0.5	0.5	0.5	0.8	0.5	1

4.2.2 Line Type Pilot

For line type pilot the interference weight assignment for various types of pilot pattern are shown in Fig.13-B and the resulting interference weight between an MS and a BS assigned for every possible pair of line type pilot are shown in Table 1-B.

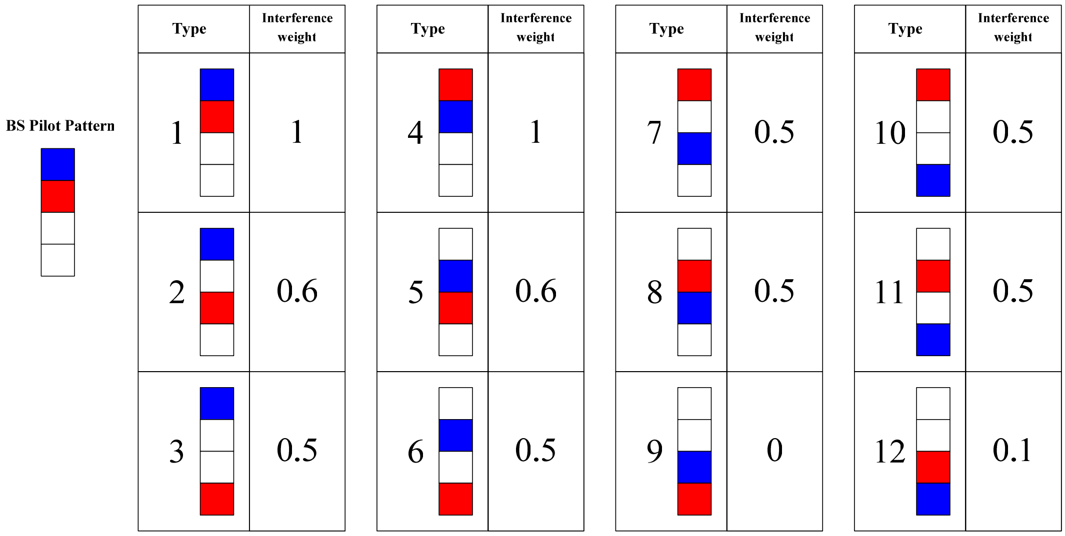


Fig. 13-B Interference weight assignment for line type pilot pattern

Table 1-B Resulting interference weight between two pilot types from line type pilot assigned for an MS and a BS

IR Pilot_MT / Pilot_BS	1	2	3	4	5	6	7	8	9	10	11	12
1	1	0.6	0.5	1	0.6	0.5	0.5	0.5	0	0.5	0.5	0.1
2	0.6	1	0.6	0.5	0.6	0.2	0.8	0.5	0.5	0.4	0.1	0.5
3	0.5	0.6	1	0.5	0.2	0.6	0.4	0	0.5	0.8	0.4	0.5
4	1	0.5	0.5	1	0.5	0.5	0.6	0.6	0.1	0.5	0.5	0
5	0.6	0.6	0.2	0.5	1	0.6	0.5	1	0.6	0	0.5	0.5
6	0.5	0.2	0.6	0.5	0.6	1	0.1	0.5	0.6	0.4	0.8	0.5
7	0.5	0.8	0.4	0.6	0.5	0.1	1	0.6	0.5	0.6	0.2	0.5
8	0.5	0.5	0	0.6	1	0.5	0.6	1	0.5	0.2	0.6	0.6
9	0	0.5	0.5	0.1	0.6	0.6	0.5	0.5	1	0.5	0.5	1
10	0.5	0.4	0.8	0.5	0	0.4	0.6	0.2	0.5	1	0.6	0.5
11	0.5	0.1	0.4	0.5	0.5	0.8	0.2	0.6	0.5	0.6	1	0.6
12	0.1	0.5	0.5	0	0.5	0.5	0.5	0.6	1	0.5	0.6	1

4.3 Pilots Assignment in TDD/FDD

4.3.1 Pilots Assignment in TDD

1) In Fig. 14, it shows the assignments of orthogonal pilot patterns for the DL and UL in the TDD multiplexing. For example in Sector A, down link has assigned the Type 1 pilot while it is assigned the pilot type 6 for the up link assignment, and these two pilot types are orthogonal each other.

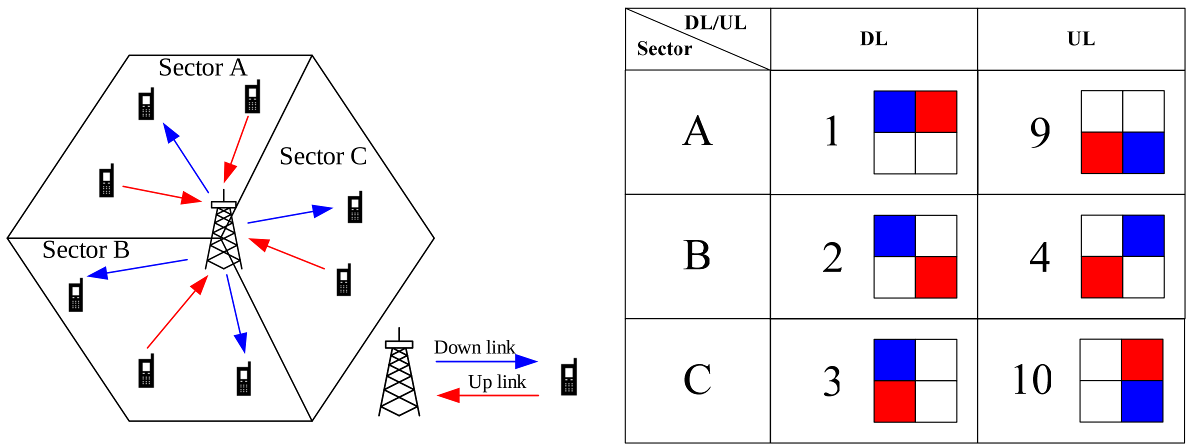


Fig. 14 Pilot assignments in TDD segments

Based on the pilot types assignment as illustrated in Fig. 14 we have in Fig. 15 the orthogonal pilot patterns assignment in one sector for the UL and DL subframes.

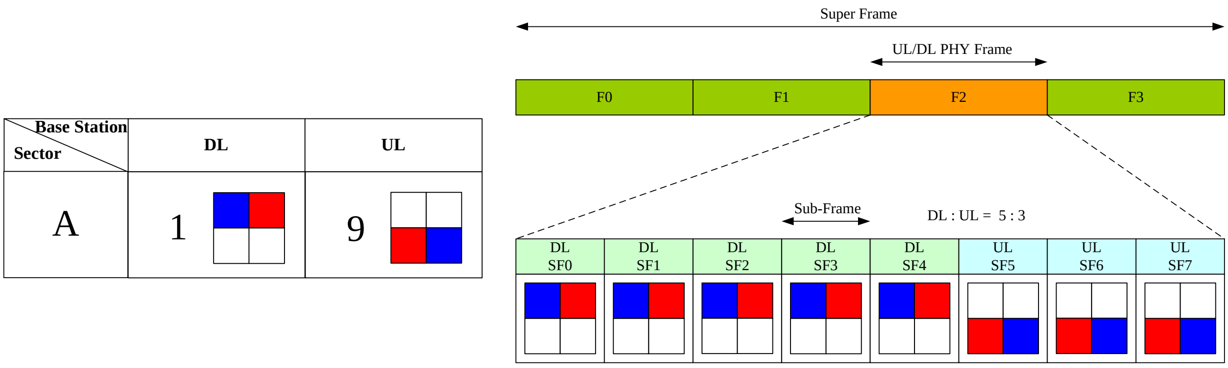


Fig. 15 Pilots assignment in TDD subframes

2) In TDD multiplexing, three groups of orthogonal pilot types are assigned for the DL and UL for three clusters as shown in Fig. 16. For example in Cluster 1, type 1 pilot is assigned for down link while it assigns type 6 pilot for the up link. In Table 3 it tabulates the interference weight between any two pilot types assigned for DL and UL among the three clusters.

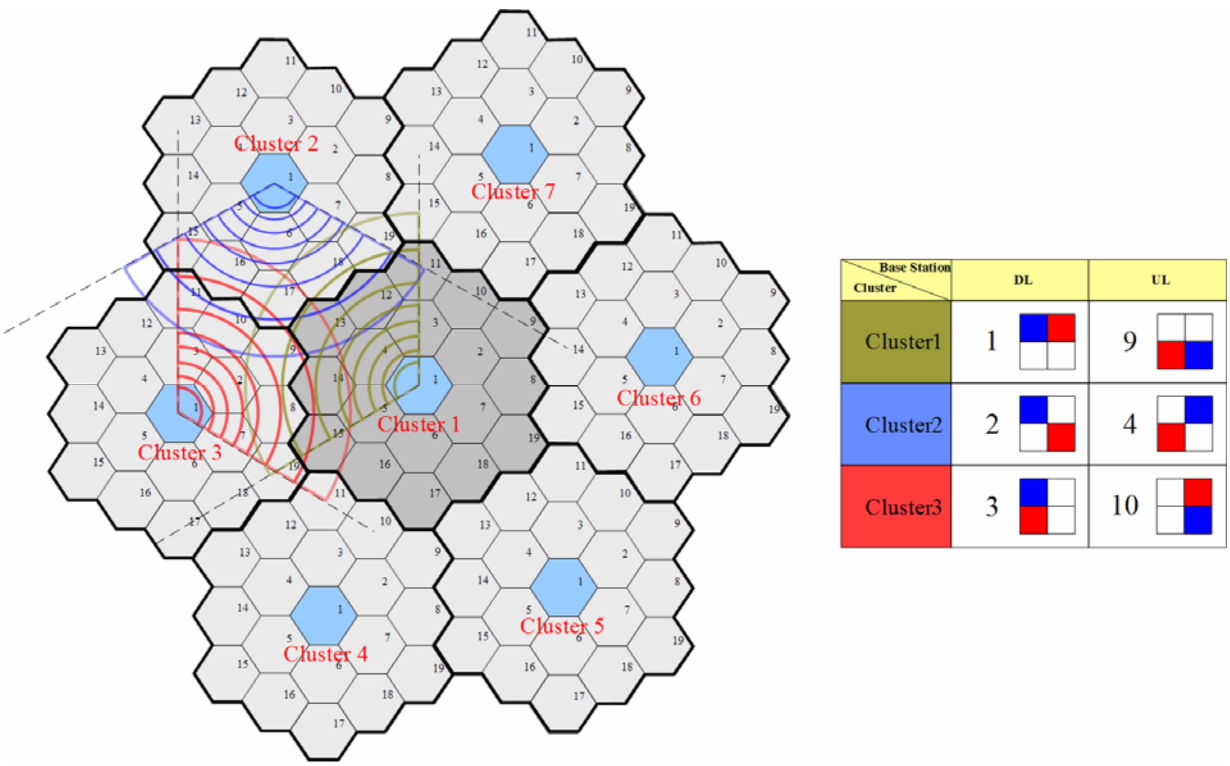


Fig. 16 Pilots Assignment in TDD

Table 3 Interference weight between any two pilot types assigned for the DL and UL among three clusters

Interference Weight		Cluster 1 DL	Cluster 1 UL	Cluster 2 DL	Cluster 2 UL	Cluster 3 DL	Cluster 3 UL
Cluster 1	DL		0	0.6	0.8	0.5	0.5
	UL	0		0.4	0.2	0.5	0.5
Cluster 2	DL	0.6	0.4		0	0.5	0.5
	UL	0.8	0.2	0		0.5	0.5
Cluster 3	DL	0.5	0.5	0.5	0.5		0
	UL	0.5	0.5	0.5	0.5	0	

4.3.2 Pilots Assignment in FDD

In FDD structure, we assign orthogonal pilot types for DL, transmitting with frequency 1, and assign another pair of orthogonal pair of pilot types for UL, transmitting with frequency 2. For example in frequency 1 assignment for the DL, user 1 is assigned the pilot type 1 while user2 is assigned the type 6 pilot, they are orthogonal each other.

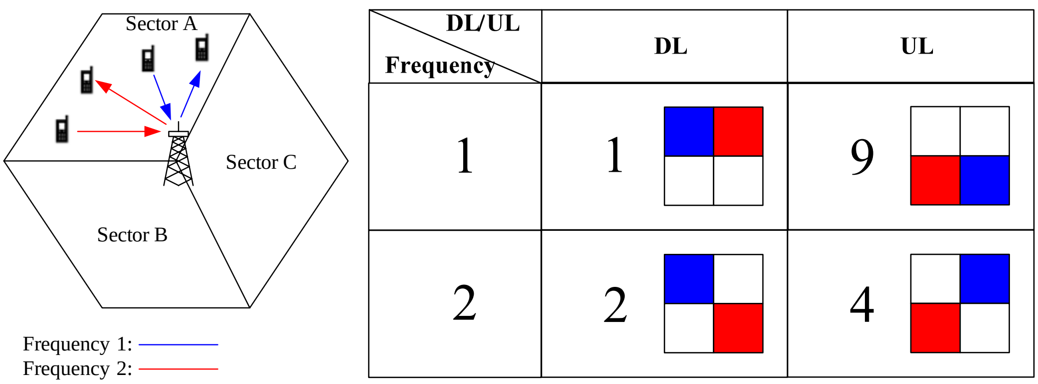


Fig.17 Pilot type assignment in FDD multiplexing

Based on the pilot type assignment as illustrated in Fig. 17 for FDD we have in Fig. 18 for frequency 1 and frequency 2 the orthogonal pilot type assignment for the DL and UL subframes.

Frequency \ User	User 1	User 2
1	1	9
2	2	4

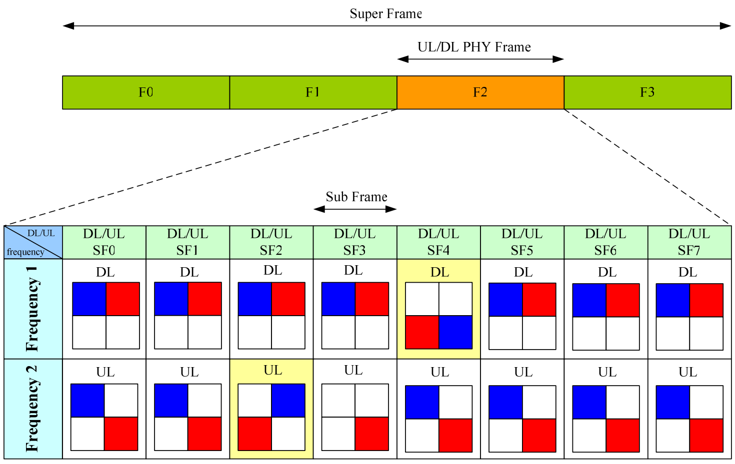


Fig.18 Pilot type assignment for DL and UL subframes in FDD multiplexing

4.3.3 Cell edge interference management

In the cell edge zone as shown in Fig. 19, the MS will receive signals not only from the serving BS but also from other BSs, therefore interference will be introduced. Orthogonal pilot patterns, as defined in Fig. 20, can be used to reduce this cell edge interference.

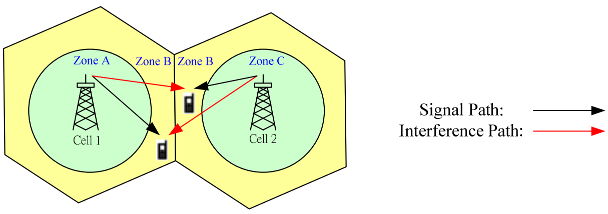


Fig. 19 Cell edge interference

Case \ Base Station	Cell1	Cell2	Interference weihgt
A	1	9	0
B	2	4	0
C	3	10	0
D	4	7	0
E	5	4	0
F	6	10	0

Fig.20 Orthogonal pilot pattern assignment for cell 1 and cell 2 when the MS is located at the cell edge

5. *Simulation Results*

Simulations will be conducted by applying the pilot types derived from considering the interference reducing effect to the 802.16 m to study its system performance.

1) Simulation for 7 BSs with frequency use factor 1

By considering seven (7) base stations with frequency reuse factor 1 we will simulate the system performance by using or without using interference reducing pilots for the paths between the MS and various BSs.

Table 4: Simulation environment for frequency reuse factor = 1

Parameter	***Value***
Carrier Frequency	2.5 GHz
System BW	10 MHz
BS Antenna Gain	17dB
MS Antenna Gain	0dB
BS height	32 M
MS height	1.5 M
Path Loss model	COST231 Hata model
Cell radius	500 M
Number of BS	7
Frequency reuse factor	1

In Fig.21, No. 4 BS is the serving base station for the MS while the neighboring base station, No.1 BS, introduces the highest interference to the MS. We can in this example use a pair of orthogonal pilots for the serving BS and this neighboring BS to reduce the resulting interference.

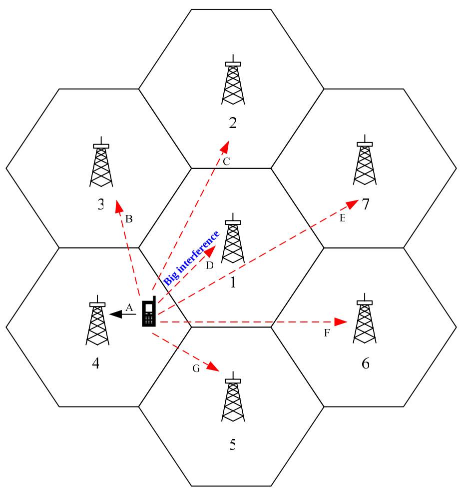
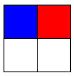
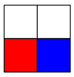
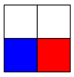
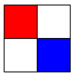
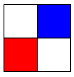
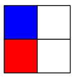
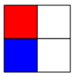


Fig. 21 Interference introduced from neighboring BSs to the MS

Table 5 Pilot type assignments for BSs

No. BS	Type	Sensitivity (dBm)
4		-119.6224
1		-131.9415
5		-135.7063
3		-135.7182
6		-143.4239
2		-143.4282
7		-145.5291

Serving BS = No. 4 Target BS = No. 1

Lets us define in Fig. 21 the signal paths A ~ G as the communication paths from various base stations to the MS, the resulting interference weight in each path is described in the following. The BS has the pilot type with its associated interference weight assigned as shown in the above table.

A. Signal path, the desired signal path

B. Interference path (interference weight: 0.4)

C. Interference path (interference weight: 0.5)

D. Interference path (interference weight: 0)

E. Interference path (interference weight: 0.5)

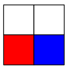
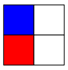
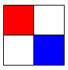
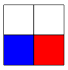
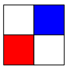
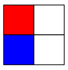
F. Interference path (interference weight: 0.6)

G. Interference path (interference weight: 0.2)

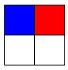
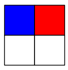
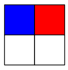
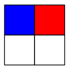
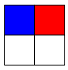
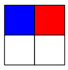
In Table 6 it tabulates the resulting interference levels when using the interference reducing pilots for the BSs and the interference levels introduced from BSs when a common pilot pattern is used for all BSs.

Table 6 Resulting Interference levels by using and without using interference reducing pilots for BSs

IR Pilot

No. BS	Type	Sensitivity (dBm)	Interference weight
1		-131.9415	0
2		-143.4282	0.5
3		-135.7182	0.4
5		-135.7063	0.2
6		-143.4239	0.6
7		-145.5291	0.5

Common Pilot

No. BS	No. BS	Sensitivity (dBm)	Interference weight
1		-131.9415	1
2		-143.4282	1
3		-135.7182	1
5		-135.7063	1
6		-143.4239	1
7		-145.5291	1

Pattern	Serving BS interference (dBm)
IR Pilot	-136.4793
Common Pilot	-128.8767

2) Simulation for 19 BSs with frequency use factor 19

In another example we consider a system with 19 base stations and with 19 reuse factors to compare the interference levels by using and without using interference reducing pilots for BSs. The parameters used in the simulation are listed in Table 7.

Table 7: Simulation environment for frequency reuse factor = 19

Parameter	***Value***
Carrier Frequency	2.5 GHz
System BW	10 MHz
BS Antenna Gain	17dB
MS Antenna Gain	0dB
BS height	32 M
MS height	1.5 M
Path Loss model	COST231 Hata model
Cell radius	500 M
Cluster	7
Number of BS	19
Frequency reuse factor	19

In Fig.22 the user's serving base station is assumed to be the cluster #3 and cluster #1 is considered to introduce the highest interference level to the MS. Orthogonal pilot types are assigned between clusters 3 and 1 while other clusters use other remaining pilot types as shown in Table 8.

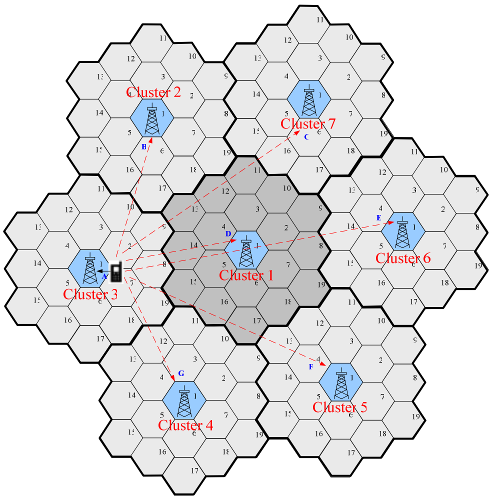
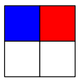
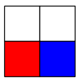
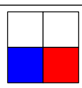
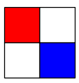
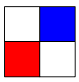
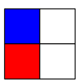
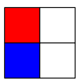


Fig. 22 MS uses the same frequency to communicate with all cluster's BSs.

Table 8 Pilots assignment for different clusters

Cluster	Type	Sensitivity (dBm)
3		-135.4475
1		-156.5196
2		-158.5863
4		-158.5863
5		-166.6907
7		-166.6907
6		-168.8460

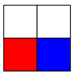
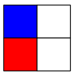
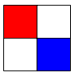
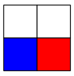
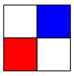
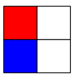
Lets us define in Fig. 22 the signal paths A~G as the communication paths from the base stations to the MS and the resulting interference weight in each path is described in the following. The BS has the pilot type with its associated interference weight assigned as shown in the above table

A. Signal path: the desired signal path
B. Interference path (interference weight: 0.5)
C. Interference path (interference weight: 0.5)
D. Interference path (interference weight: 0)
E. Interference path (interference weight: 0.6)
F. Interference path (interference weight: 0.2)
G. Interference path (interference weight: 0.4)

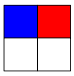
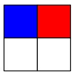
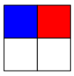
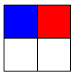
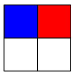
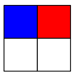
In Table 9 it tabulates the resulting interference levels when using the interference reducing pilots for the BSs and the interference levels introduced from BSs when a common pilot pattern is used for all BSs.

Table 9 Resulting Interference levels by using and without using interference reducing pilots for BSs

IR Pilot

No. Cluster	Type	Sensitivity (dBm)	Interference weight
1		-156.5196	0
2		-158.5863	0.5
4		-158.5863	0.4
5		-166.6907	0.2
6		-168.8460	0.6
7		-166.6907	0.5

Common Pilot

No. Cluster	No. BS	Sensitivity (dBm)	Interference weight
1		-156.5196	1
2		-158.5863	1
4		-158.5863	1
5		-166.6907	1
6		-168.8460	1
7		-166.6907	1

Pattern	Cluster interference (dBm)
IR Pilot	-158.3135
Common Pilot	-135.3844

6. Conclusion

When we introduced the interference reducing pilots for the various communication links we reduce the interference level by 7.5 dB for 7 base stations with frequency reuse factor 1 and the interference level reduce by 23 dB for 19 base stations when the use factor is 19.

Proposed Text for SDD

------------------------------- **Text Start** --

11.X DL/UL control

11.X.1 Interference management

1) Frame structure for the control channel

Insert the following statements in the text

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

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

(3) **FM (Frame Map)**: This FM is used to designate MSs locations in the sub-frame for those MSs are not in the interference-reducing zone (IR-Zone).

(4) **SFM (Sub-frame Map)**: 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 of the zone location, the orthogonal pilot pattern and it also will provide the relative location information of the UL- Zone.

(5) **IR-Zone (Interference Reducing 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.

(6) **UL-IRR (Uplink–interference Reducing Request)**: 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.

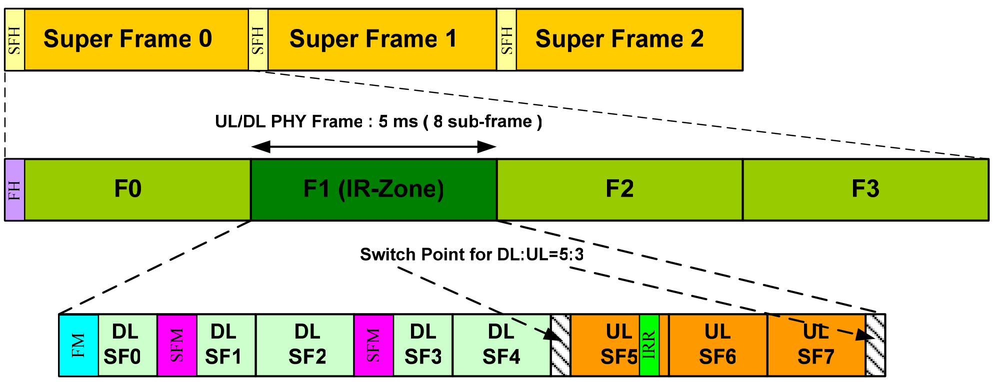


Fig. A (a) Control channel structure for TDD

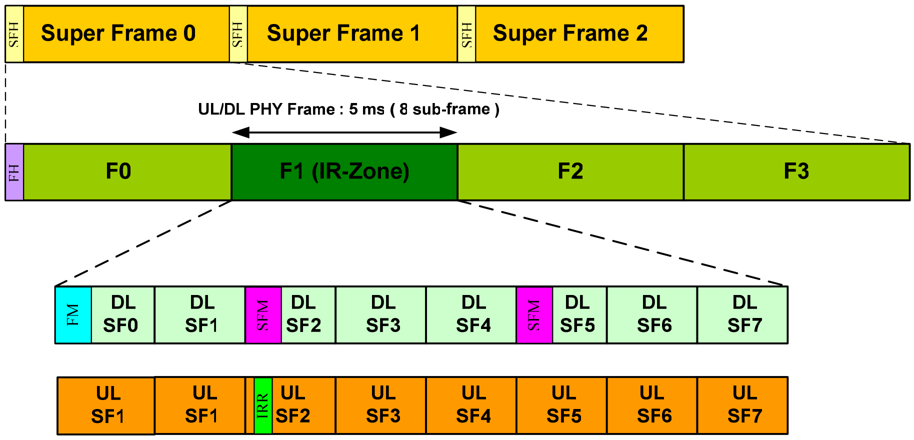


Fig. A (b) Control channel structure for FDD

2) Interference Reducing Pilot Patterns

With properly designed pilot patterns that they have power interference weight between two any pairs of pilots we can have the system interference level lower than the system that has the same weight assigned for all pilots.

------------------------------- **Text End** ---

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[2] Sophie Vrzic, Mo-Han Fong, Robert Novak, Jun Yuan, Dongsheng Yu, Sang-Youb Kim, Anna Tee, Kathiravetpillai Sivanesan, Nortel Networks, “Proposed SDD Text on Downlink Control Structure “ IEEE 802.16 Broadband Wireless Access Working Group, C80216mDL_ctrl-08_023

[3] Kang Rui, Liu Ying, Guan Yanfeng, Lu ZhaohuaZTE Corporation ,”Proposed Text from IEEE C80216m-08/224r2 for Downlink Control Structure in P802.16m SDD ”IEEE 802.16 Broadband Wireless Access Working Group, C80216mDL_ctrl-08_024

[4] Fan Wang, Bishwarup Mondal, Mark Cudak, Amitava Ghosh, Tim Thomas, Fred Vook ,”Proposal on SDD Text on Downlink Control Structure ” IEEE 802.16 Broadband Wireless Access Working Group, C80216mDL_ctrl-08_025

[5] Sun Changyin, Wangwenhuan, Liumin ZTE Corporation, Yang Lian Huawei Technologies, “Proposed SDD Text of DL Control Structure based on IEEE C80216m-08/225r3 ” IEEE 802.16 Broadband Wireless Access Working Group, C80216m-08_027

[6] Youngsoo Yuk, Heejeong Cho, Jeongki Kim, Kiseon Ryu Ronny(Yong-Ho) Kim LG Electronics, ” Proposed Text for 16m SDD on Downlink Control Structure” IEEE 802.16 Broadband Wireless Access Working Group, C80216m-08_032r1