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Re:	This contribution is for call for contribution IEEEP802.16e
Abstract	This contribution proposes the safety channel allocation and handover procedure
Purpose	Propose the safety channel handover mechanism for the IEEE802.16e.
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es>.

Safety Channel Handover Procedure

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Introduction

In order to reduce the interference caused by a neighboring BS, an MSS moving toward its Serving cell boundary may be switched from its current data channel to the safety channel (or safety zone) defined for the neighboring BS. Since the safety channel itself shall not be used in the neighboring BS, the MSS using this channel in the Serving BS can be served with less interference. This transition to the safety channel is triggered based on the MSS report, which includes some neighboring BSs with their CINR levels exceeding a predefined SafetyCH_Threshold. Then the Serving BS chooses a BS with the highest CINR level and requests the safety channel information of the BS. If the corresponding channel in the Serving BS is available, it is allocated to the MSS. Otherwise the BS should force the MSS to perform a handover to the neighbor BS.

Proposed Mechanism

We propose the safety channel operation in the following two cases.

- Case 1: Safety channel allocation in serving cell
- Case 2: After performing a safety channel handover, Safety channel allocation in target cell

1) Case 1: Safety channel allocation in serving cell

As the MSS, while in communication with its Serving BS, moves toward cell boundary, its signal interference by neighbor cells is increasing. If the signal interference from neighbor cells exceeds the predefined SafetyCH_Threshold, the MSS shall report the CINR value of each neighbor BS. The Serving BS, after requesting the safety channel information of the neighbor BS with the highest CINR and receiving the information through SafetyCH-Info messages, allocates the MSS the channel corresponding to the safety channel of the neighbor BS. The Serving BS sends to the neighbor BS SafetyCH-Alloc-Info with Alloc flag set to 1 in case where the safety channel allocation succeeds.

The example of safety channel operation in serving cell is depicted in figure 1 and figure 2.

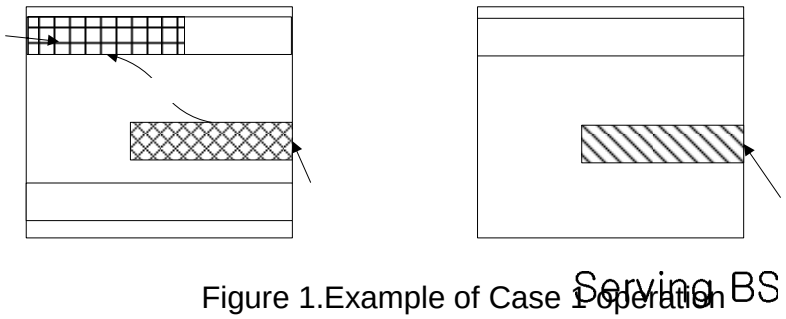


Figure 1.Example of Case 1 operation

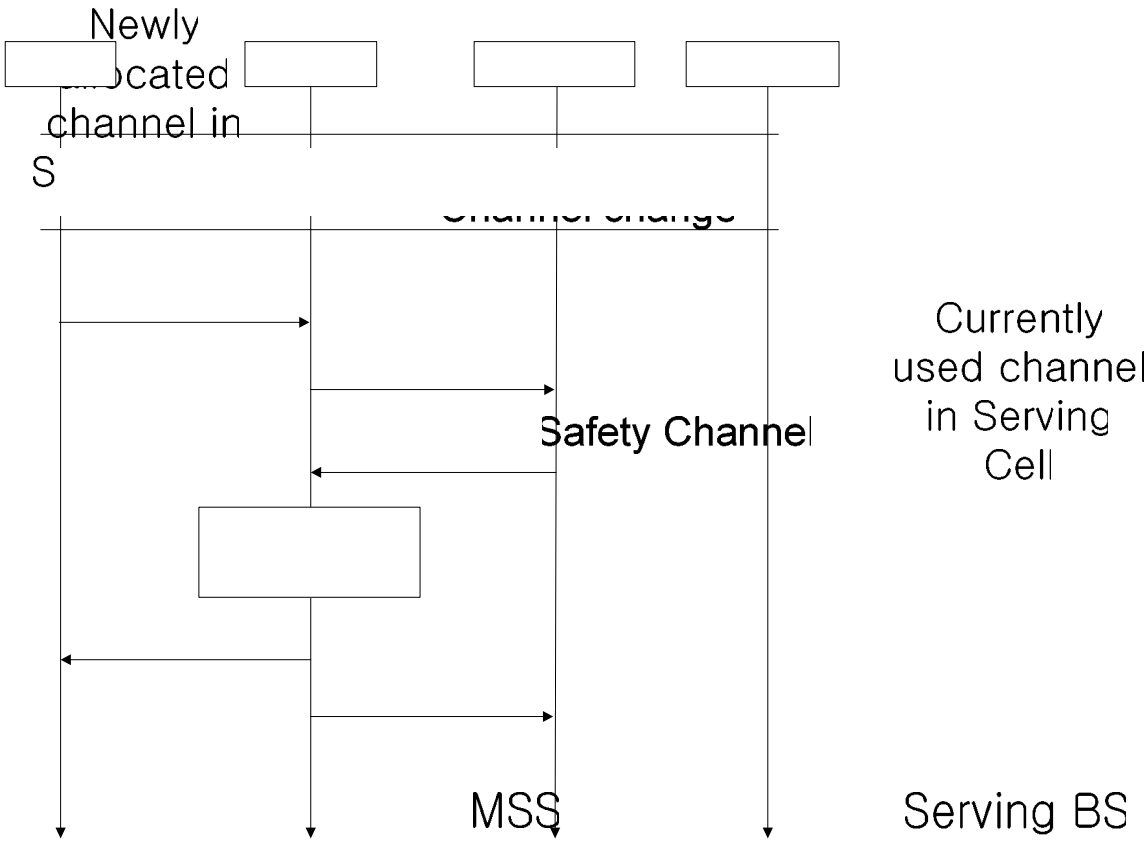


Figure 2.Safety channel operation in case 1

2) Case 2: After performing safety channel handover, Safety channel allocation in target cell

As stated in case 1, MSS requests the safety channel if neighbor BSs' CINR exceed the predefined Safety CH_Threshold. However, the Serving BS cannot allocate the safety channel of neighbor BS in case where the channel is already fully used for other MSSs and BSs. Therefore the Serving BS forces the MSS to perform Safety Channel Handover to the neighbor BS and use the Serving BS's safety channel after performing the handover. Through SafetyCH-Alloc-Info with Alloc flag set to 1, the Serving BS informs the neighbor BS that the channel, corresponding to the neighbor BS's safety channel, is unavailable in the serving cell and the MSS will move to the neighbor BS. The SafetyCH-Alloc-Info message also contains the

safety channel information of the Serving BS. At this time, the Target BS may grant the MSS non-contention based ranging opportunity to the MSS.
The example of safety channel handover operation is depicted in figure 3 and figure 4.

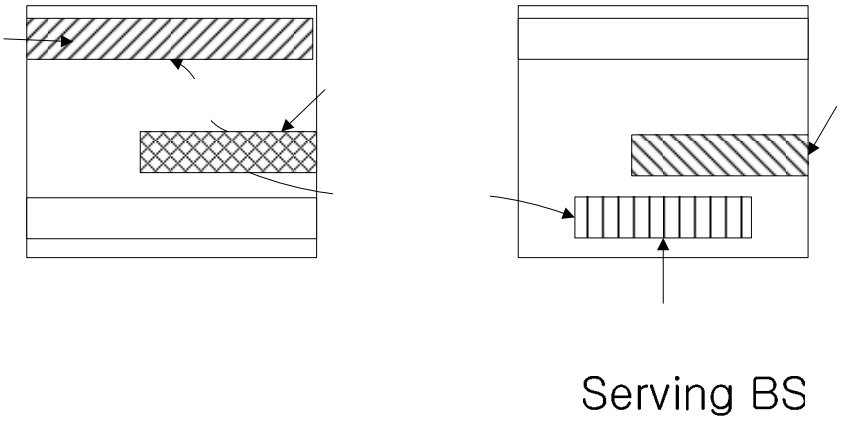
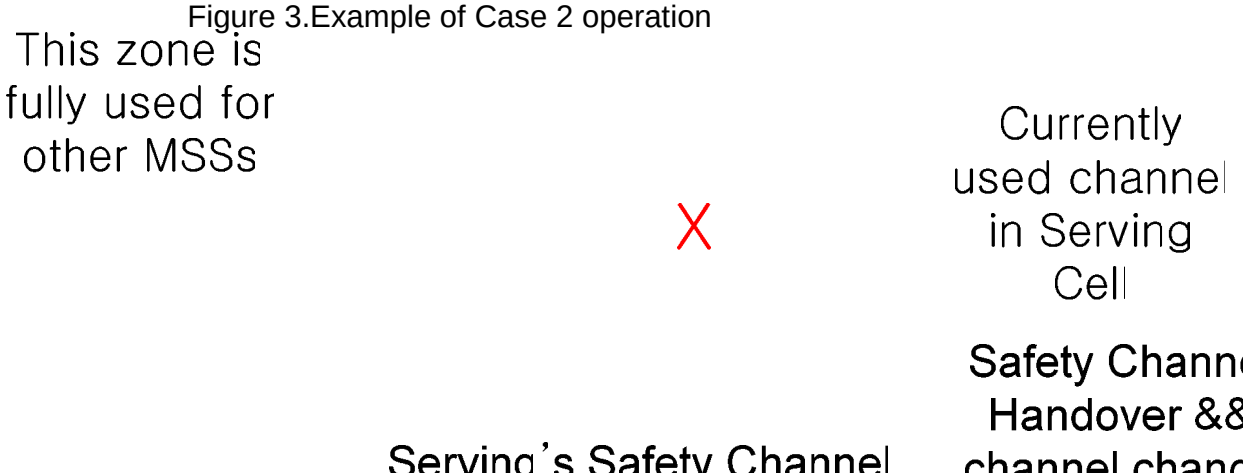


Figure 3.Example of Case 2 operation



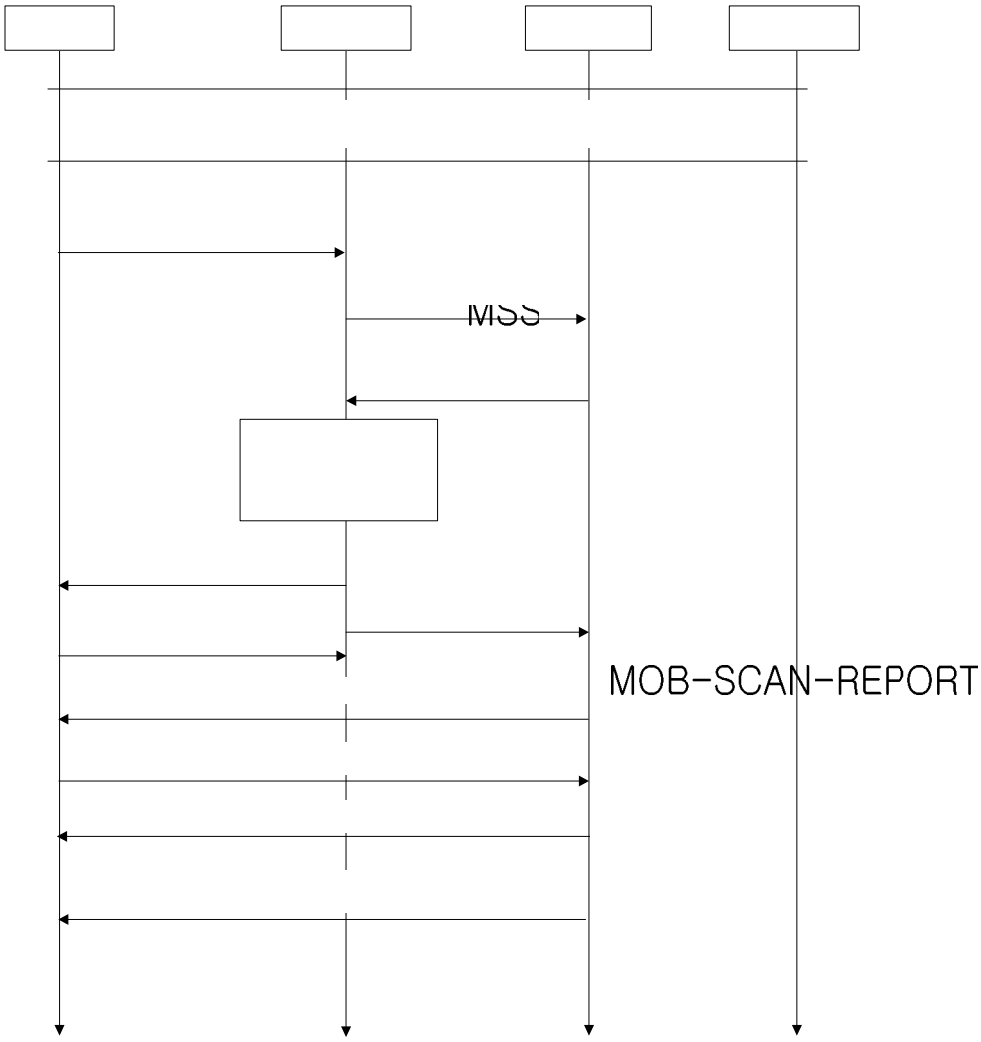


Figure 4.Safety channel operation in case 2

Therefore we propose the remedies as followings:

- Add the safety channel handover operation after line 8 in page 46 and line 45 in page 50.
- Add the following field to Table 92h MOB-BSHO-REQ message format in page 25.
  - Handover mode
- Add the following SBC-RSP TLV encoding in page 108.
  - SafetyCH_Threshold
- Add a new section D.2.14 and D.2.15 after the section D.2.13 in page 125.
  - D.2.14 SafetyCH-Info message
  - D.2.15 SafetyCH-Alloc-Info message

Proposed Text Changes

We propose the following remedies in IEEE P802.16e/D3 to provide the efficient safety channel handover operation.

Remedy 1:

[Add the followings after line 8 page 46 section 6.3.20.1.2 MSS Scanning of neighbor BS]

If the received CINRs of neighbor BSs exceed the predefined SafetyCH_Threshold, the MSS reports the scanning result to its Serving BS. Then the Serving BS may try to allocate the channel corresponding to the safety channel of the neighbor BS with the highest CINR. If the corresponding channel in the Serving BS is available, it is allocated to the MSS. Otherwise the Serving BS forces the MSS to perform handover to the neighbor BS and after handover new Serving BS allocates MSS safety channel of old Serving BS. These cases require that the Serving BS and the neighbor BS exchange the safety channel information over the backbone.

Remedy 2:

[Change the followings in line 36-40 page 50 section 6.3.20.2.2 HO decision & initiation]

If Handover mode is set to "01" in MOB-BSHO-REQ message, MSS may perform a hand-over to any BS among the recommended BSs in MOB-BSHO-REQ without notifying the Serving BS of a selected Target BS. As an acknowledgement to the MOB-BSHO-REQ message, the MSS may send a MOB-HO-IND message with its Target BS ID set to a pre-defined value other than any valid BS identifier.

[Add the followings after line 45 page 50]

If Handover mode is set to "10" in MOB-BSHO-REQ message, MSS shall perform a handover to the Target BS in recommended BS list after sending MOB-HO-IND message. Handover mode "10" means that the MSS may not use the safety channel in its serving cell and therefore it shall change its connection to the Target BS. The Serving BS notifies the Target BS that the MSS will move to the Target BS, which may provide non-contention based ranging opportunity to the MSS. The Serving BS also informs the Target BS of the Serving BS's safety channel information over the backbone. The Target BS shall allocate the channel to the MSS performing Safety channel handover to the target cell.

Remedy 3:

[Change the table 92h in page 25]

Table 92h – MOB-BSHO-REQ Message Format

Syntax	Size	Notes
MOB-BSHO-REQ_Message_Format(){		
Management Message Type = 52	8bits	
Handover mode	2bits	00: Network Assisted HO is not supported 01: Network Assisted HO is supported 10: Safety Channel Handover 11: reserved
For(j=0;j<N_Recommended;j++){		N_Recommended can be derived from the known length of the message
Neighbor BS-ID	48bits	
Service level prediction	8bits	
}		
Reserved	6bits	Reserved; shall be set to zero

HMAC Tuple	21bytes	See 11.4.11
}		

[Change the following in line 25-31 page 26]

Handover mode

This flag indicates that the Serving BS supports the Network Assisted HO features. This flag also indicates that the Serving BS forces the MSS to handover to the Target BS in N_Recommended list. The following applies:

00 = Network Assisted HO is not supported
01 = Network Assisted HO is supported
10 = Safety Channel Handover
11 = reserved

Remedy 4:

[Insert the following after the end of section 11.8.3 in page 108]

11.8.4 SafetyCH_Threshold

This field indicates the predefined CINR threshold to report MSS's scanning result for safety channel handover operation.

Type	Length	Value	Scope
1(TBD)	1	SafetyCH_Threshold	SBC-RSP (see 6.3.2.3.24)

Remedy 5:

[Insert the following messages after the end of section D.2.13 in page 125]

D. 2.14 SafetyCH-Info message

This message is sent from the Serving BS to the neighbor BS to request the neighbor BS's safety channel information. This message is also sent from the neighbor BS to the Serving BS in order to inform the neighbor's safety channel information in case where the neighbor BS received SafetyCH-Info message with Info-request set to 0. The message contains the following information:

Field	Size	Notes
SafetyCH-Info_Message_Format(){		
Global Header	152bits	
Info-request	1bit	0: Request safety channel information 1: Inform safety channel information
TLV_Safety_channel_info	Variable	Safety channel information for case where in fo-request value is set to 1.
Security field	TBD	A means to authenticate this message
CRC field	32bits	IEEE CRC-32
}		

TLV_Safety_channel_info(){		
OFMDA symbol offset	8bit	
Subchannel offset	7bit	
No. OFDMA symbols	7bit	
No. subchannels	7bit	
}		

D. 2.15 SafetyCH-Alloc-Info message

This message is sent from the Serving BS to the neighbor BS, which provided its safety channel information, to inform whether the Serving BS successfully allocates the safety channel to the MSS. If the safety channel allocation fails, the Serving BS informs the neighbor BS of the MSS's handover and the Serving BS's safety channel information. The message contains the following information:

Field	Size	Notes
SafetyCH-Alloc-Info_Message_Format(){		
Global Header	152bits	
Alloc flag	1bit	Indicate whether the BS allocates the safety channel which provided from other BS. 0: Allocation fail and Safety Channel Handover for the MSS will happen. 1: Allocation success
MSS unique identifier	48bits	48bit unique identifier used by MSS. This field informs the ID of MSS to perform Safety Channel Handover and is activated for case where Alloc flag is set to 0
TLV_Safety_channel_info	Variable	This field informs the BS's safety channel information and is activated for case where Alloc flag is set to 0. (the same format with TLV_Safety_channel_info in SafetyCH-Info message)
Security field	TBD	A means to authenticate this message
CRC field	32bits	IEEE CRC-32
}		