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Abstract	This document contains suggestions to enhance message transfers for initializing Scan, Sleep, and Idle Mode.
Purpose	Adoption of proposed changes into P802.16e
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Enhancements to the Message Transfers for the initialization of Scan, Sleep, and Idle Mode

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1. Introduction

1.1 Problem Statement

In the current IEEE 802.16e document, MOB-SCN-REQ/MOB-SCN-RSP, MOB-SLP-REQ/MOB-SLP-RSP and DREG-REQ/DREG-CMD are used to initialize Scanning, Sleep, and Idle Mode. However, the operational procedures are not explicitly described in case that each request or response message would be lost in the air links due to the limited resource or unexpected change in the wireless environment. As it were, although an MSS sends a request message (MOB-SCN-REQ or MOB-SLP-REQ or DREG-REQ) to a BS, the BS would not receive this message, or although a BS sends a response message (MOB-SCN-RSP or MOB-SLP-RSP or DREG-CMD) to an MSS, the MSS would not receive this message. Therefore, if an MSS sent a request message to a BS and didn't receive a response message, it would be possible that the MSS might malfunction, because the timer and the retry count for the request message is not defined. Figure 1 shows theses cases.

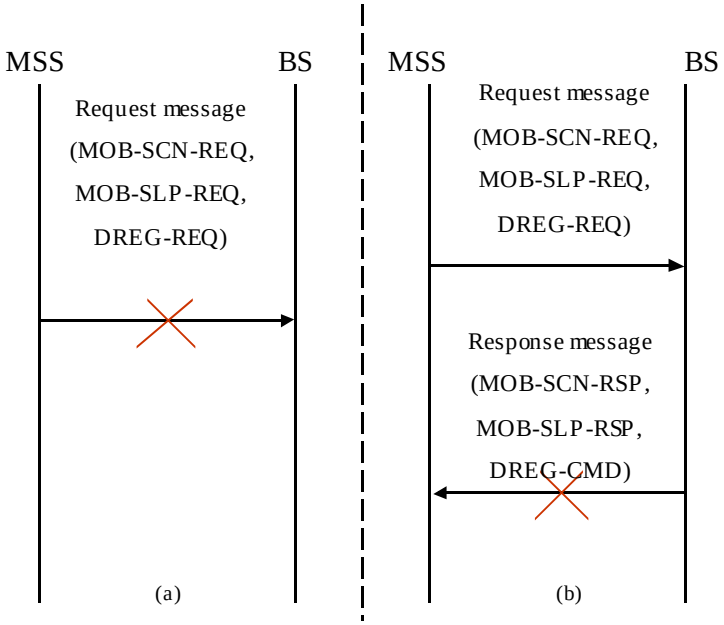


Figure 1. The example of the loss for either request or response message

In this contribution, to solve theses problems, we propose the timers for each response message and the retry counts for each request messages, and describe the operational procedures for an MSS to retransmit the request message in case that the MSS sent a request message to a BS, and did not receive a response message within a specified time.

Also, our contribution defines Management_Resource_Holding_Timer for Idle Mode. This timer is set up for the BS to maintain connection information (basic, primary and secondary connection, etc.) with the MSS during a specified time after the BS send a DREG-CMD message to the MSS. Without this timer, the MSS cannot have any connection to retransmit the DREG-REQ message to the BS, because the BS releases connection information of the MSS as soon as it sends DREG-CMD message to the MSS as shown in Figure 2.

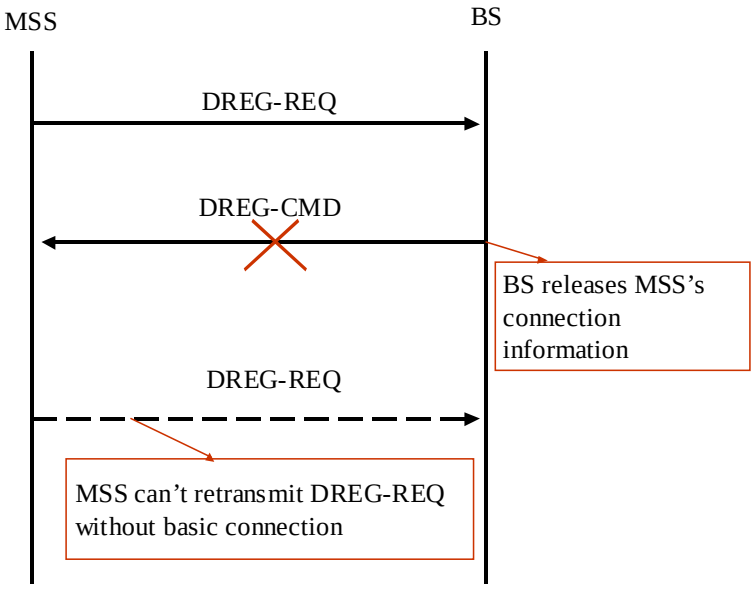


Figure 2. The example of the loss for DREG-CMD

1.2 The SDLs of the operations using the proposed scheme

Figure 3 and 4 are the SDLs which show the operational procedure for an MSS to initialize Scanning using the proposed timer and retry count. As shown in these figures, the MSS shall start T31 timer after issuing a MOB-SCN-REQ message. If the MSS does not receive a MOB-SCN-RSP message until T31 timer expires, it shall try to retransmit a MOB-SCN-REQ message to the BS as long as the scan request retry count has not been exhausted.

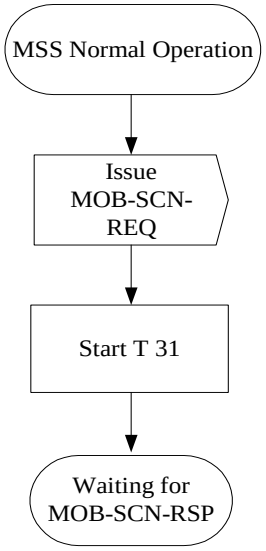


Figure 3. Scan Request – MSS

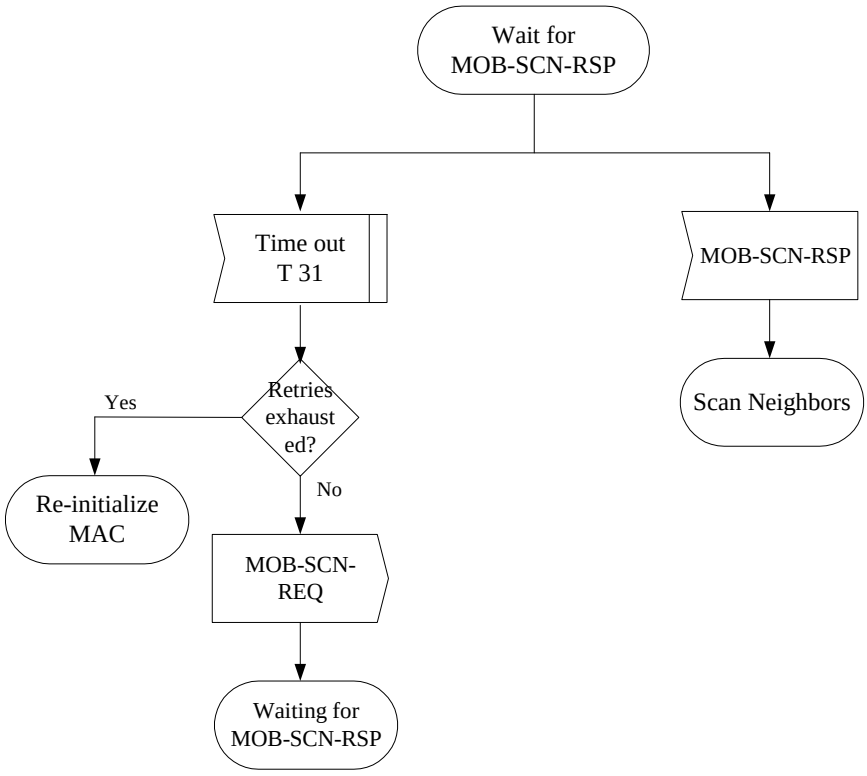


Figure 4. Wait for MOB-SCN-RSP – MSS

Figures 5, 6, and 7 show the SDLs which shows the operational procedures for an MSS and BS to initialize Idle Mode using the proposed timer and retry count.

As shown in Figures 5 and 6, the MSS starts T32 timer after issuing a DREG-REQ message. If the MSS does not receive a DREG-CMD message until T32 timer expires, the MSS shall try to retransmit a DREG-REQ message as long as the DREG request retry count has not been exhausted. In Figure 7, after receiving a DREG-REQ message from the MSS, the BS

responds with a DREG-CMD message with Action Code 0x05 if the BS requires MSS de-registration and request initiation of MSS Idle Mode. Then, the BS shall start Management_Resource_Holding_Timer. If the timer expires, the BS shall release connection information of the MSS to be maintained.

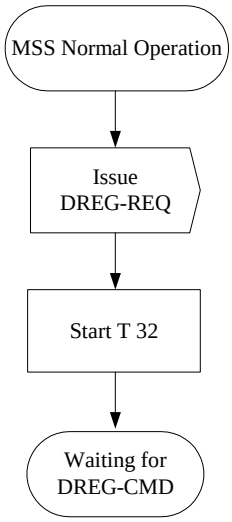


Figure 5. DREG-REQ – MSS

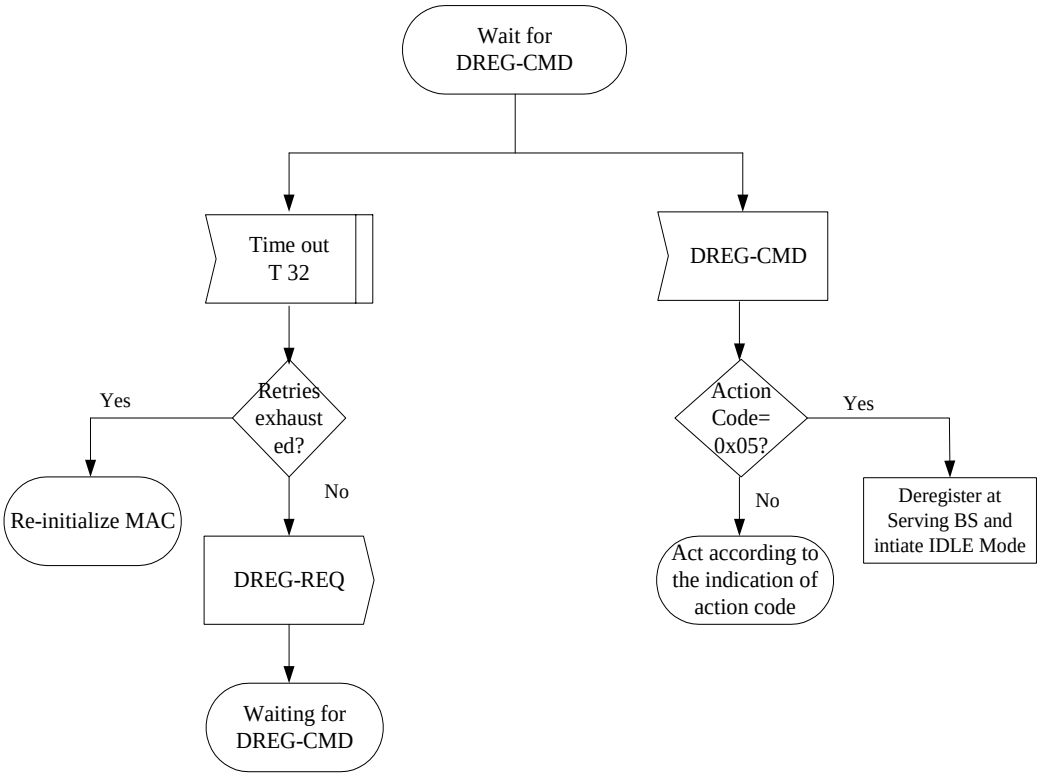


Figure 6. Wait for DREG-CMD – MSS

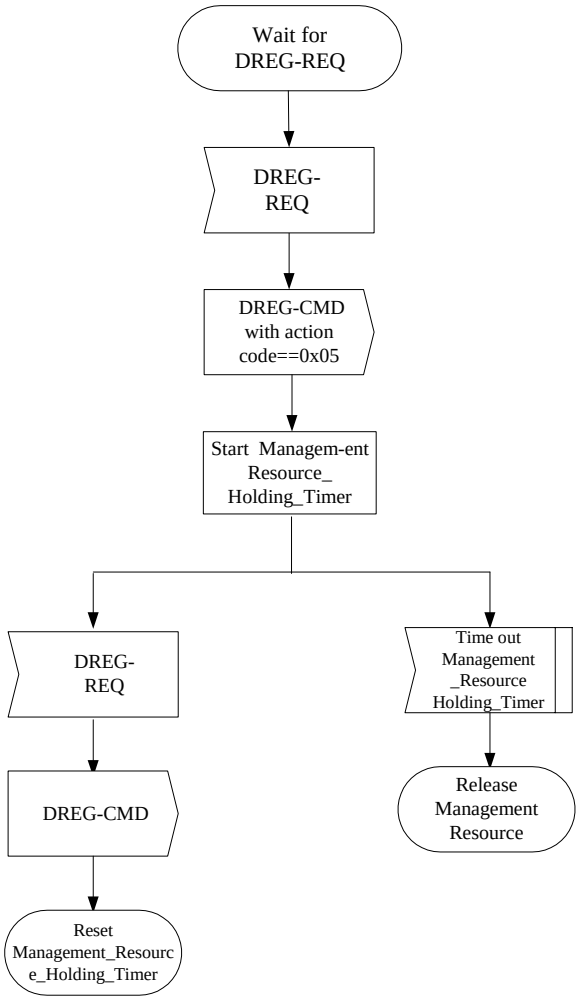


Figure 7. Wait for DREG-REQ – BS

2. Proposed Text Changes in Document

Remedy 1

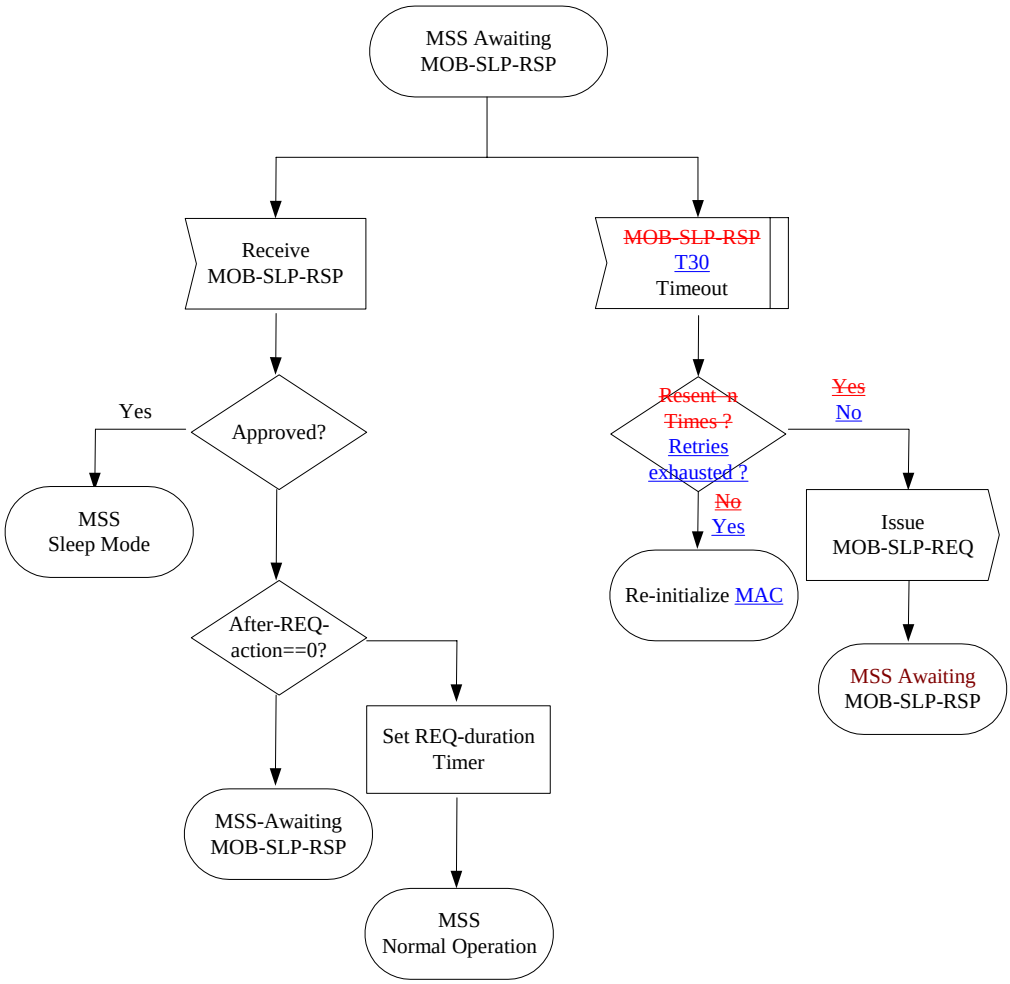
Add the text to describe the procedure to retransmit MOB-SLP-REQ message, while a retry count is not exhausted if an MSS sent a MOB-SLP-REQ message to a BS and did not receive a MOB-SLP-RSP message within a specified time, and modify Figure 130-b.

[In 6.3.19.1 Introduction of Sleep-mode for mobility-supporting MSS, page 102, line 63, add the following sentence as]:

Before entering Sleep Mode the MSS shall inform the BS using MOB-SLP-REQ and obtain its approval. The BS shall respond with an MOB-SLP-RSP message. If the MSS does not receive the MOB-SLP-RSP message within T30 timer expiry after it sends the MOB-SLP-REQ message to the BS, the MSS shall retransmit the MOB-SLP-REQ message as long as

retry count has not been exhausted. Otherwise, the MSS shall re-initialize MAC. The Serving BS may send an unsolicited MOB-SLP-RSP to the MSS to initiate MSS Sleep Mode. After receiving an approving MOB-SLP-RSP message from the BS, an MSS shall enter Sleep Mode at the appropriate frame prescribed by the message.

[In 6.3.19.1 Figure 130b-MSS Awaiting Sleep Response SDL Diagram, page 106, modify the following Figure as]:



Remedy 2

Add the text to describe the procedure to retransmit MOB-SCN-REQ message, while a retry count is not exhausted if an MSS sent a MOB-SCN-REQ message and did not receive a MOB-SCN-RSP message within a specified time.

[In 6.3.20.1.2 MSS Scanning of neighbor BS, page 113, line 12, add the following sentence as]:

An MSS may request an allocation of a scanning interval using the MOB-SCN-REQ MAC

Management message. The MSS indicates in this message the estimated duration of time it requires for the scan. Upon reception of this message, the BS shall respond with a MOB-SCN-RSP MAC Management message. If the MSS does not receive the MOB-SCN-RSP message within T31 timer expiry after it sends the MOB-SCN- REQ message to the BS, the MSS shall retransmit the MOB-SCN-REQ message as long as retry count has not been exhausted. Otherwise, the MSS shall re-initialize MAC.

Remedy 3

Add the text to describe the procedure to retransmit DREG-REQ message, while a retry count is not exhausted if an MSS sent a DREG-REQ message and did not receive a DREG-CMD message within a specified time, and Management_Resource_Holding_Timer for a BS to maintain connection information with an MSS.

[In 6.3.21.1 MSS Idle Mode Initiation, page 130, line 57, add the following sentence as]:

–Idle mode Initiation may begin after de-registration. During Normal Operation with its Serving BS, an MSS may signal intent to begin Idle Mode by sending a DREG-REQ with a Deregistration_Request_Code = 0x01; request for MSS de-registration from Serving BS and initiation of MSS Idle Mode. Similarly, a Serving BS May signal for an MSS to begin Idle Mode by sending a DREG-CMD with an Action Code=0x05. If the MSS does not receive the DREG-CMD message within T32 timer expiry after it sends the DREG-REQ message to the BS, the MSS shall retransmit the DREG-REQ message as long as retry count has not been exhausted. Otherwise, the MSS shall re-initialize MAC. Also, the BS shall start Management_ Resource_ Holding_Timer to maintain connection information with the MSS as soon as the it send the DREG-CMD message to the MSS, If T32 timer expires, the BS shall release connection information with the MSS.

Remedy 4

Define each timer waiting for each response message, each retry count for each request message, and Management_Resource_Holding_Timer.

[In 10.1 Global Values, page 175, Table 340a-Parameters and Constants, Append to table]:

System	Name	Time Reference	Minimum Value	Default Value	Maximum Value

MSS	T30	Time the MSS waits for MOB-SLP-RSP			500ms
MSS	T31	Time the MSS waits for MOB-SCN-RSP			500ms
MSS	T32	Time the MSS waits for DREG-CMD			500ms
BS	Management Re-Source Holding Timer	Time the BS maintain connection information with the MSS after the BS send DREG-CMD to the MSS			1s
MSS	Sleep Request Retry Count	Number of retries on Sleep Request Message	3	3	16
MSS	Scan Request Retry Count	Number of retries on Scan Request Message	3	3	16
MSS	DREG Request Retry Count	Number of retries on DREG Request Message	3	3	16