

## RS Sleep Mode

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Kanchei (Ken) Loa, Hua-Chiang Yin,  
Yi-Hsueh Tsai, Shiann Tsong Sheu,  
Yung-Ting Lee, Youn-Tai Lee,  
Frank C.D. Tsai, Heng-Iang Hsu,  
Chih-Chiang Hsieh, Tien-Hsiang Lo  
Institute for Information Industry  
8F, No. 218, Sec. 2, Dunhua S. Rd.,  
Taipei City 106, Taiwan, ROC.

Voice: +886-2-27399616

Fax: +886-2-23782328

E-mail: loa@nmi.iii.org.tw

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Purpose:

This contribution proposes RS sleep mode procedure and restrictions.

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# Introduction

- Sleep mode defined in IEEE 802.16e-2005 is essential for conserving power and radio resources on access link
- This contribution discusses the RS Sleep Mode for conserving RS power, and radio resources on access link and relay link

## Requirements for RS Sleep Mode

- For mobile RS
  - Mobile RS powered by battery
- For fixed/nomadic RS
  - RS without power wire connection
    - e.g., RS relying on solar power as primary or backup power source
  - RS with power wire connection
    - e.g., RS operating with the battery-powered UPS when power fails
  - For eco-awareness reason

# Design Objectives

1. Support of RS sleep mode is **optional**
2. Support of RS sleep mode **shall** not need any change on MS
3. RS sleep mode **shall** be centralized controlled at MR-BS in MR networks with centralized scheduling or distributed scheduling
4. RS sleep mode **should** support MS event-based actions (e.g., MOB\_SCN-REQ / MOB\_SCN-REP / MOB\_MSHO-REQ).
5. RS sleep mode **should** support MS mobility and MS network entry/re-entry/handover
6. RS sleep mode **should** support various RS deployment scenarios

## Design Considerations

- The trigger methods of RS sleep mode shall be initiated by either RS itself or MR-BS
- The trigger methods of MS sleep mode are still initiated by either MS or MR-BS as defined in IEEE 802.16e-2005

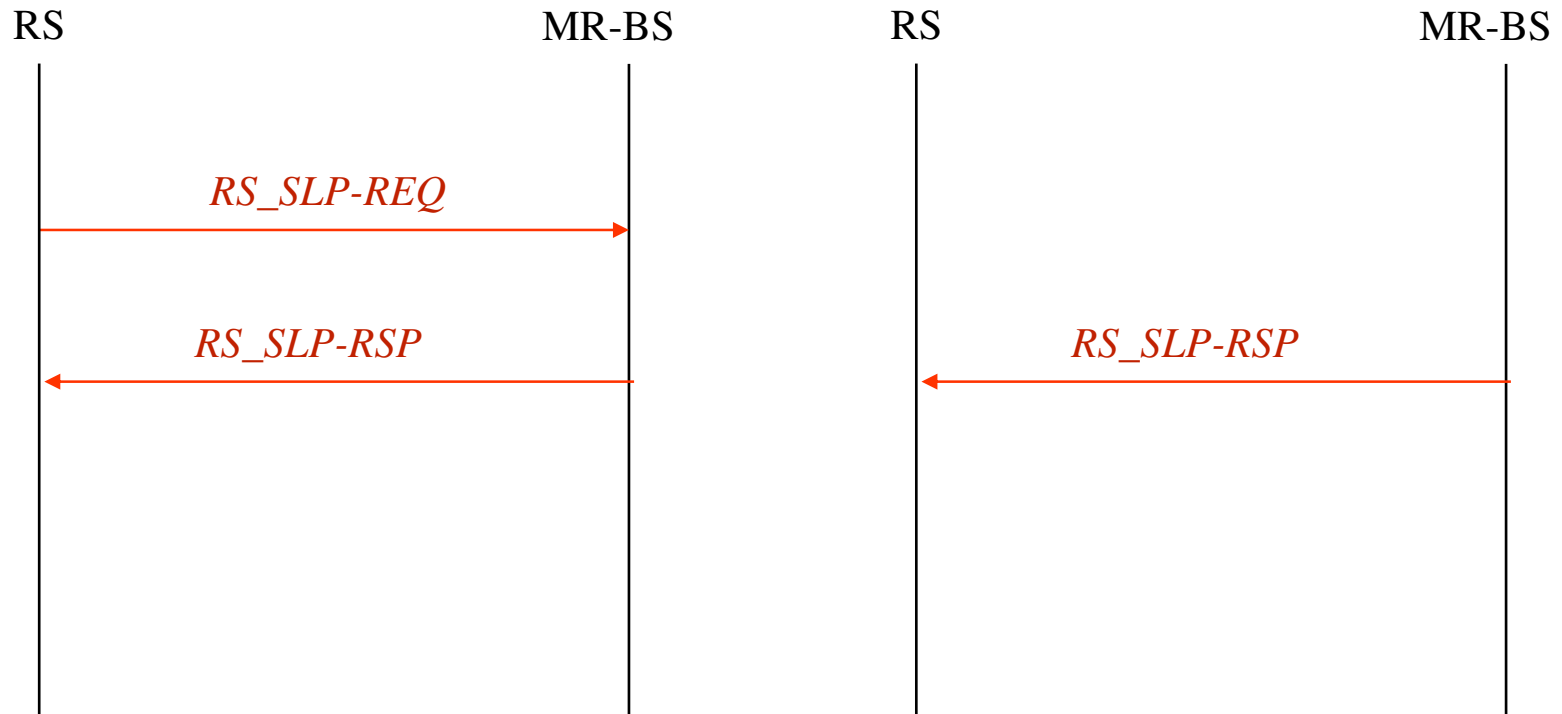
# Principles of Centralized Control

- MR-BS is responsible for controlling RS sleep mode
- MR-BS and MS exchange MS sleep mode messages end-to-end and RS shall have the associated information

# RS Sleep Mode

- RS could get into sleep mode only when all subordinated MSs and RSs are in sleep mode
- RS sleep mechanism:
  - RS can request the activation of RS sleep mode by exchanging RS\_SLP-REQ/RS\_SLP-RSP messages with MR-BS
  - Alternatively, RS sleep mode is activated by MR-BS by sending unsolicited RS\_SLP-RSP to designated RS
  - RS is notified sleep information of all subordinate MSs and RSs by MR-BS
  - The RS sleep window shall be less than or equal to the overlapping time interval of all sleep windows of connections of subordinate MS(s) and RS(s)
- RS wake up mechanism:
  - The RS can wake up via the notification of MOB\_TRF-IND sent by the MR-BS
  - The RS can also wake up by itself when it wants to send data to the MR-BS

# RS Sleep Mode Initiation



*RS-initiated*

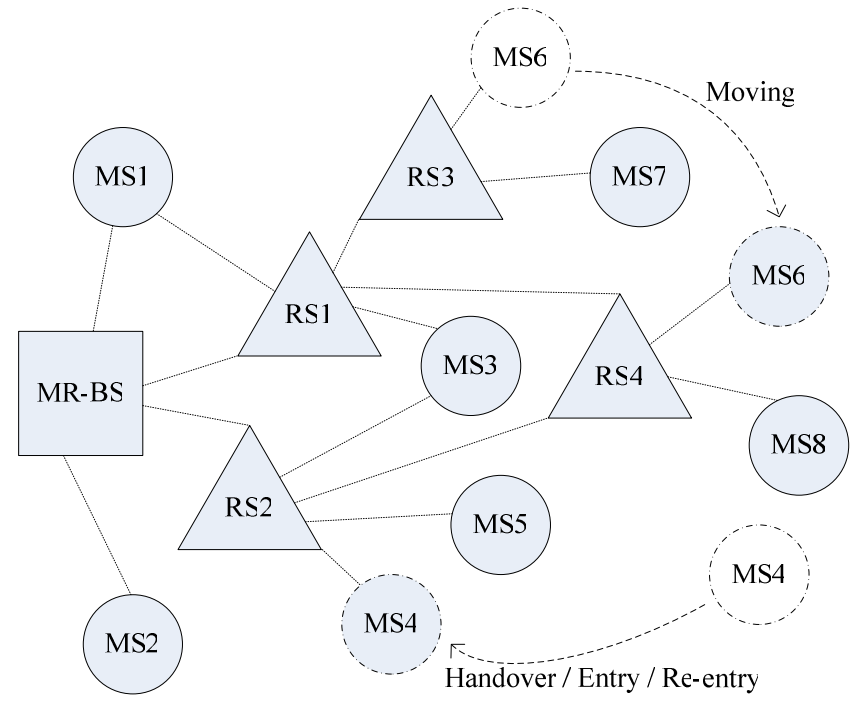
*MR-BS-initiated*



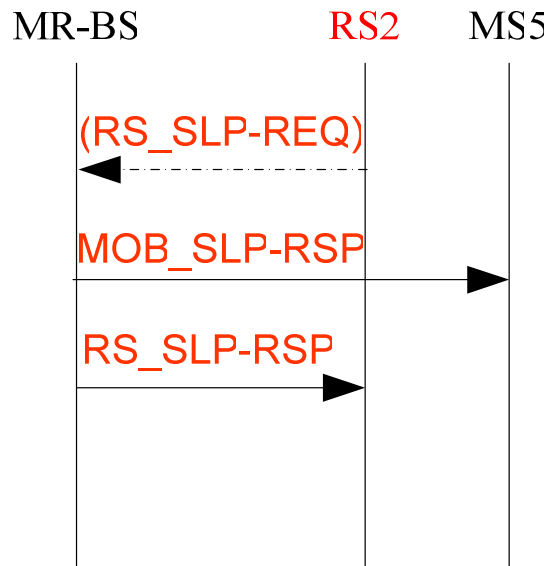
## Types of RS Sleep Mode

- Full RS Sleep Mode
  - No traffic at relay link and access link
- Partial RS Sleep Mode
  - No traffic at relay link or access link except the DL Start Frame Preamble, FCH, DCD, UCD, DL\_MAP, UL\_MAP, broadcast messages, etc., sent by RS at predefined intervals
  - When the RS supports its subordinate MS event-based actions, it shall send the DL Start Frame Preamble, FCH and UL\_MAP, and allocate UL BW for bandwidth requests. In addition, the interval between two consecutive UL BW allocations shall be less than the lost UL-MAP Interval defined in IEEE 802.16-2004
  - RS in Partial RS Sleep Mode may
    - Send its own broadcast messages
    - Relay broadcast messages from MR-BS

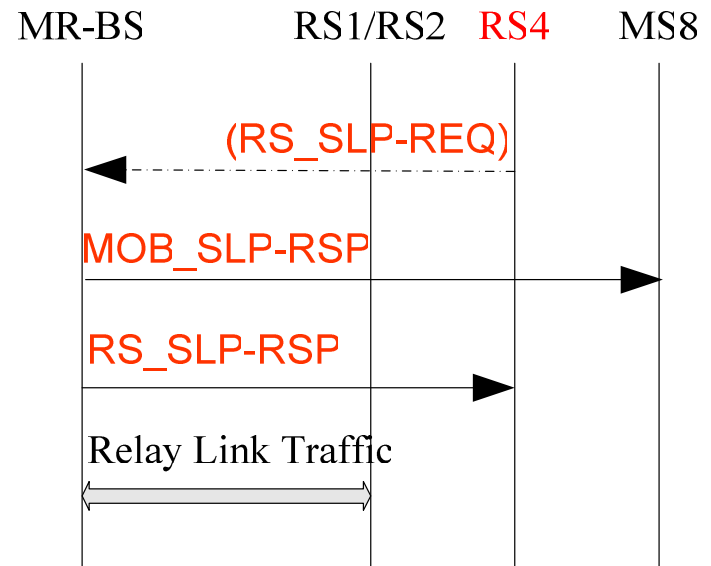
# Examples of Full RS Sleep Mode



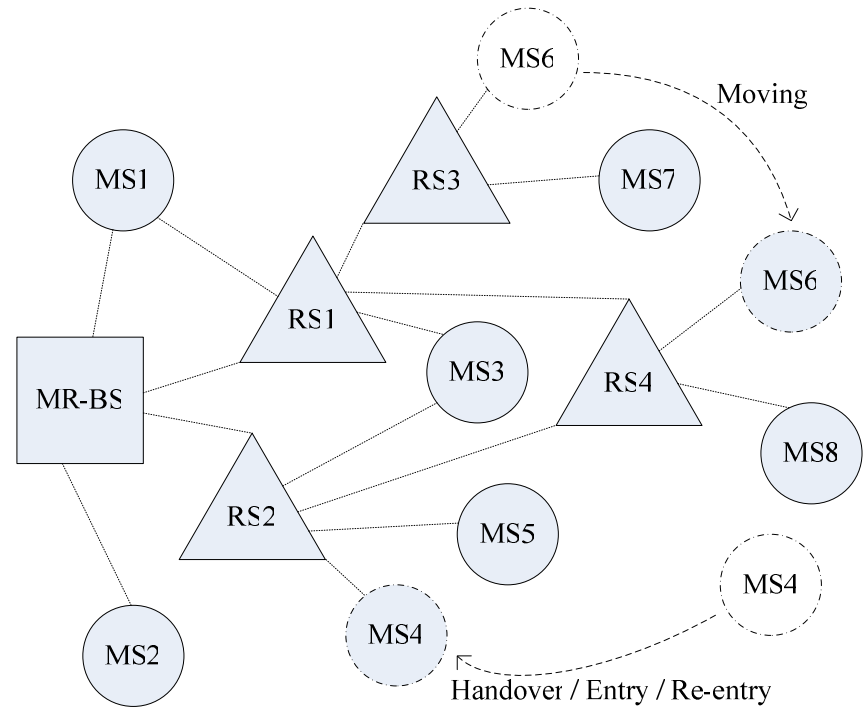
Ex 1:



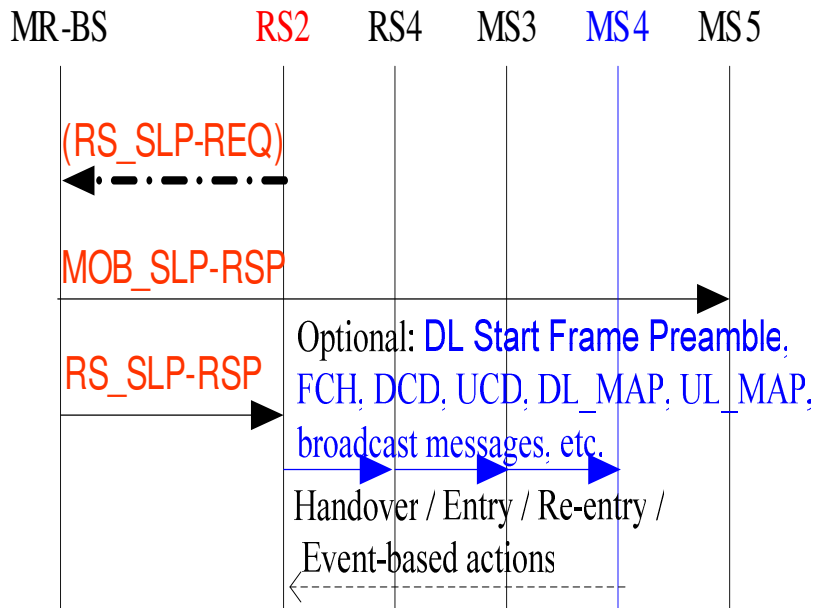
Ex 2:



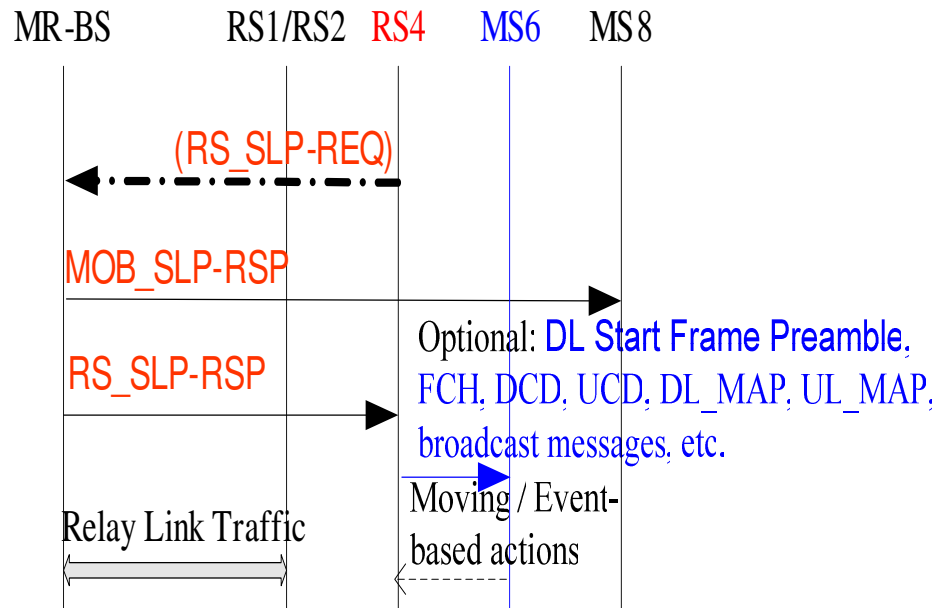
# Examples of Partial RS Sleep Mode



Ex1:



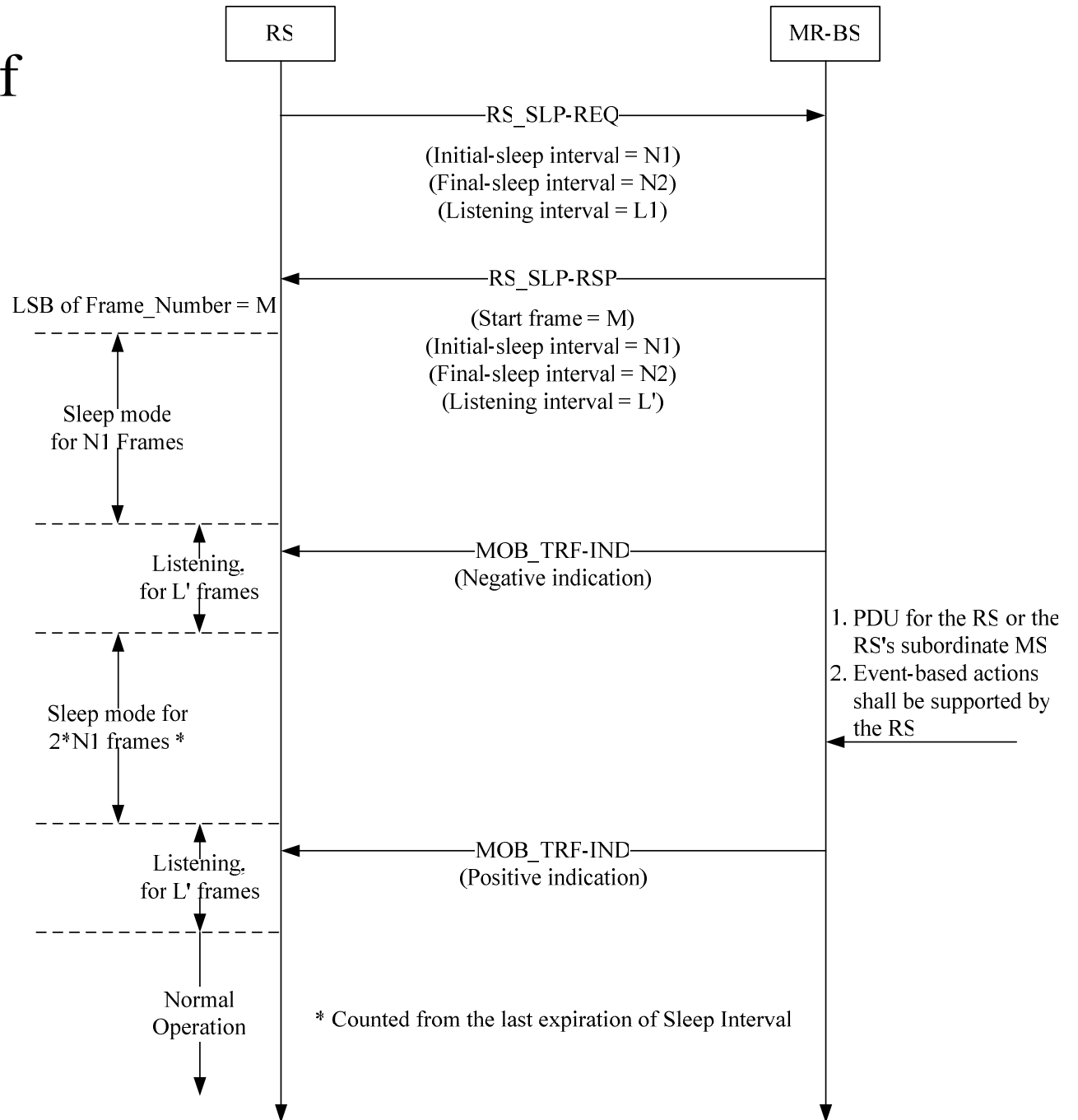
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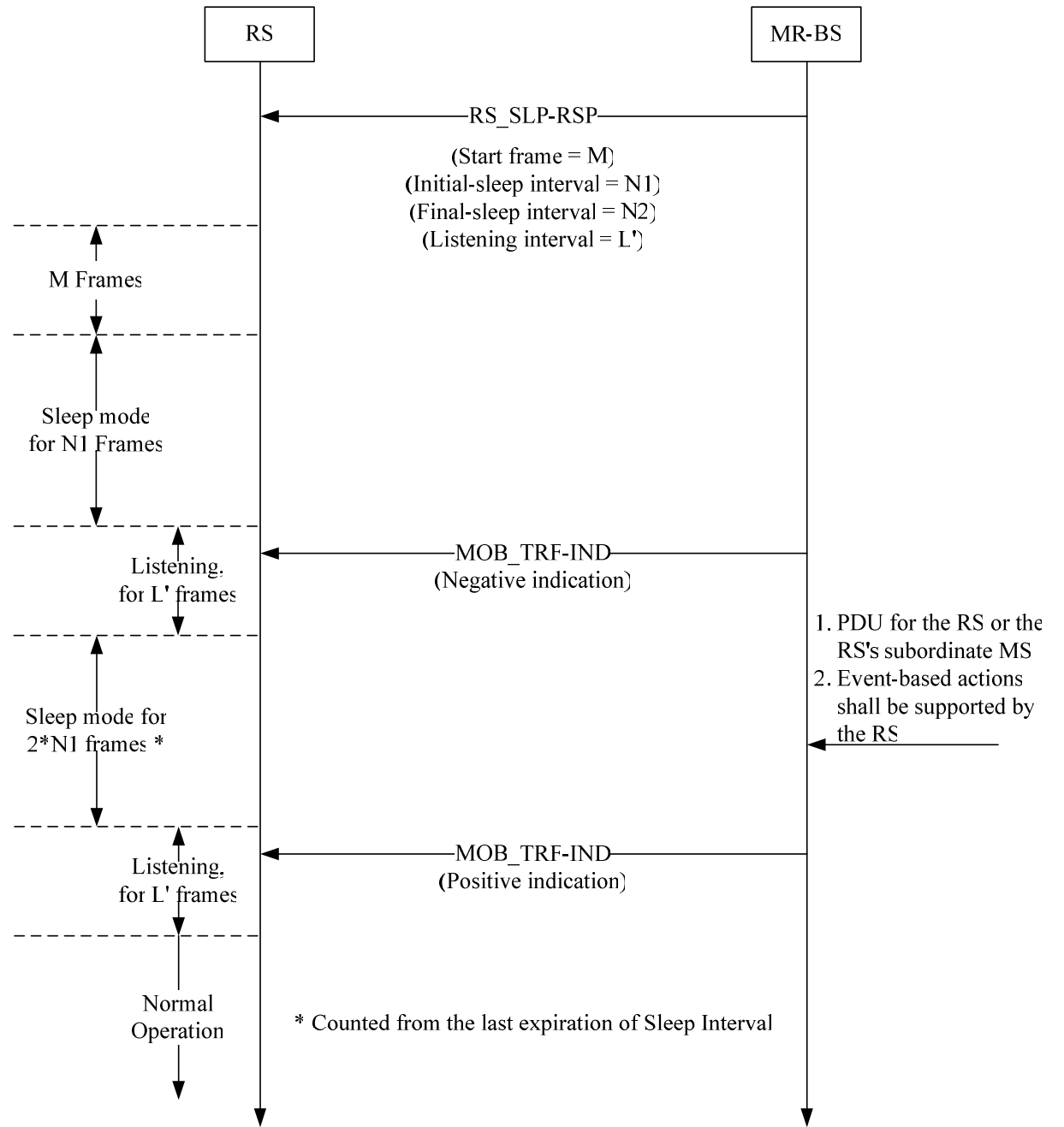
## Conclusions

- Propose procedures for RS sleep mode
  - Full and partial RS sleep mode procedures
  - **RS\_SLP-REQ/RSP** management messages between MR-BS and RS to support RS sleep mode
- The partial RS sleep mode is proposed to support MS event-based actions such as MS mobility, MS network entry/re-entry, etc

# Example MSC of RS sleep mode initiated by RS



# Example MSC of RS sleep mode initiated by MR-BS



# Example MSC of RS awakening initiated by RS

