RS Sleep Mode

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Purpose:

This contribution proposes RS sleep mode procedure and restrictions.

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

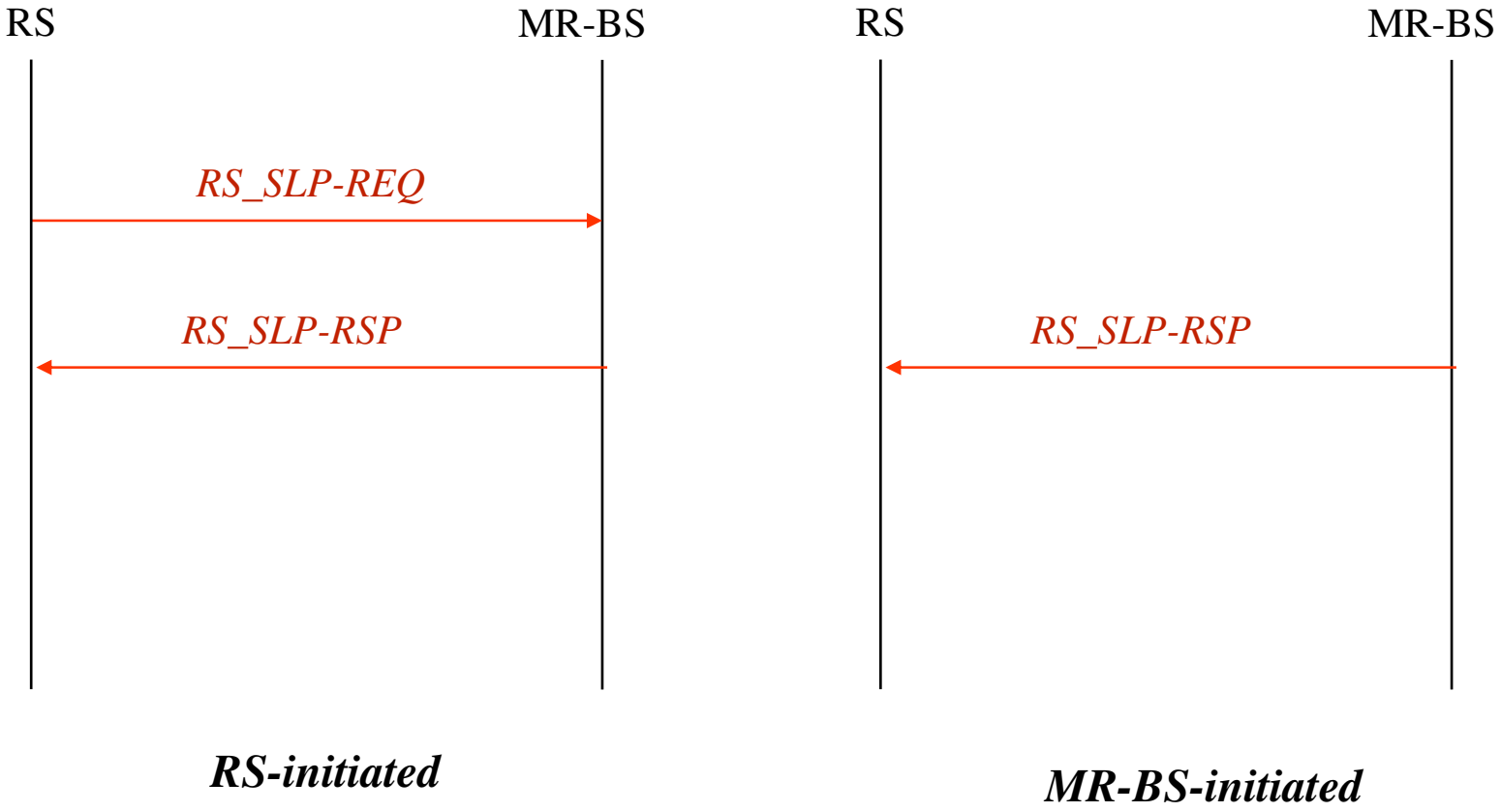
Principles of Centralized Control

- 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

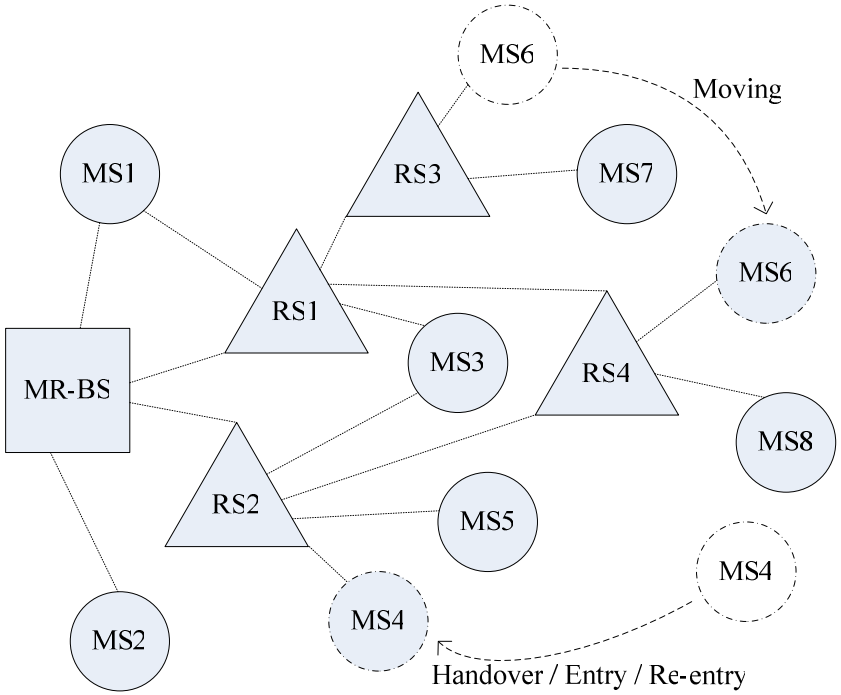
RS Sleep Mode Initiation



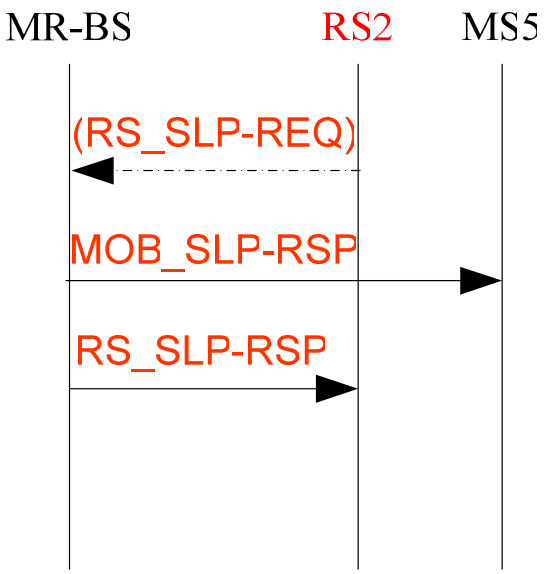
Types of RS Sleep Mode

- 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

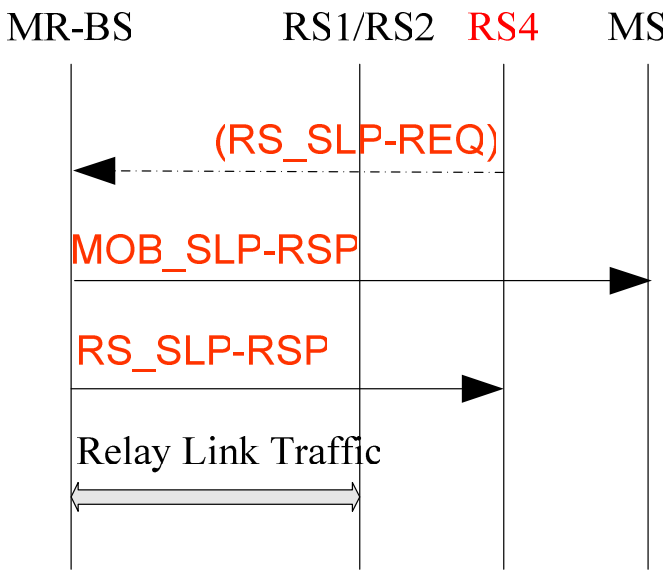
Examples of Full RS Sleep Mode



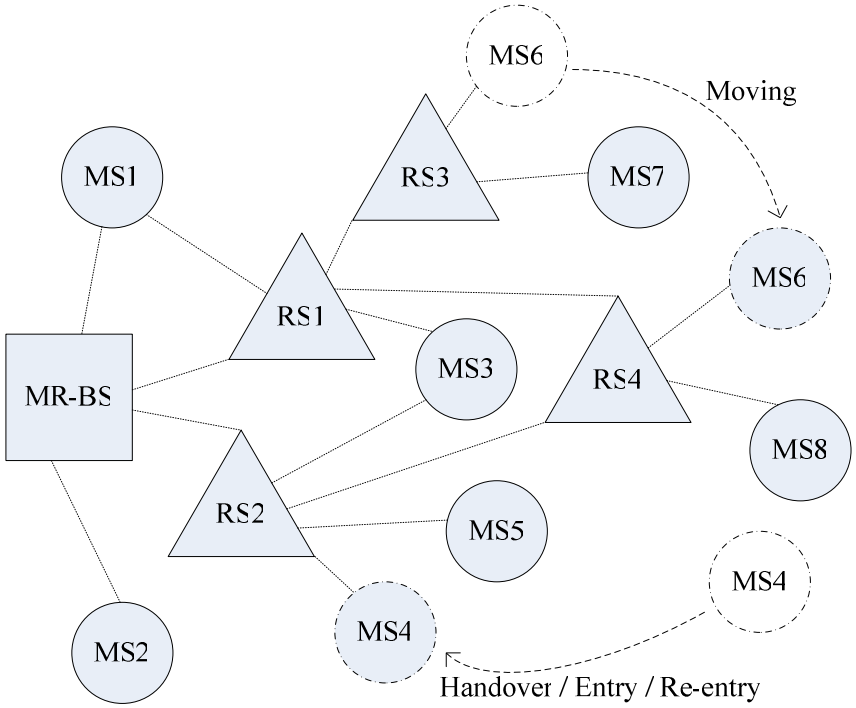
Ex 1:



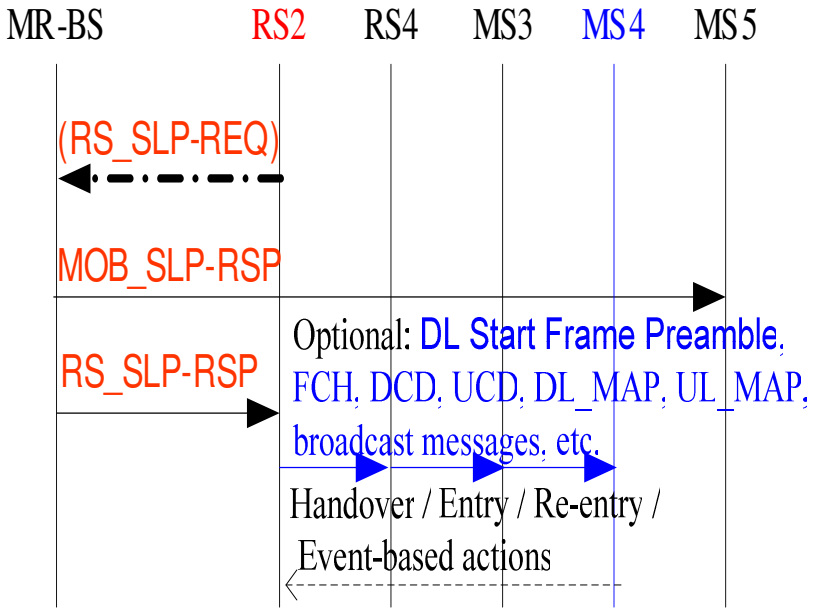
Ex 2:



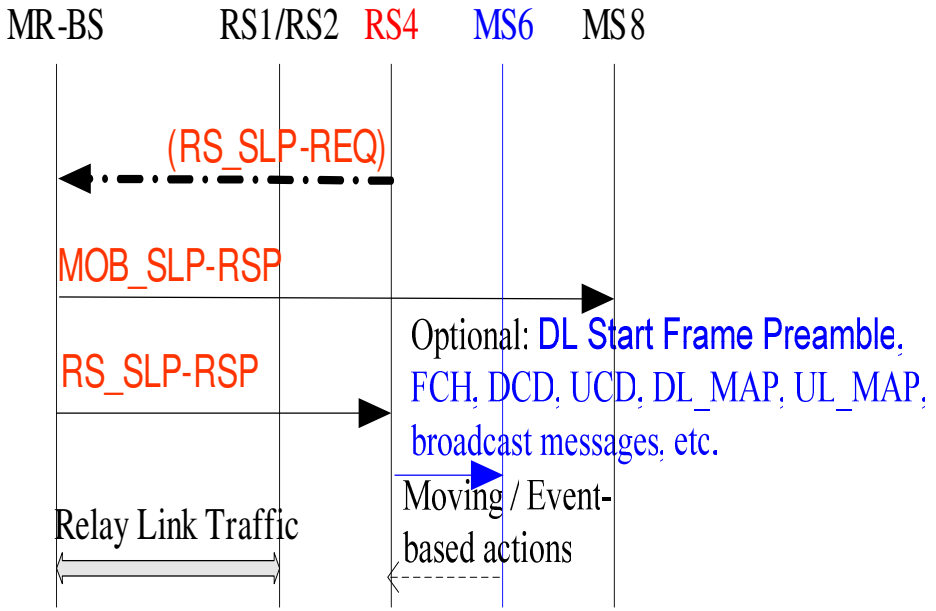
Examples of Partial RS Sleep Mode



Ex 1:



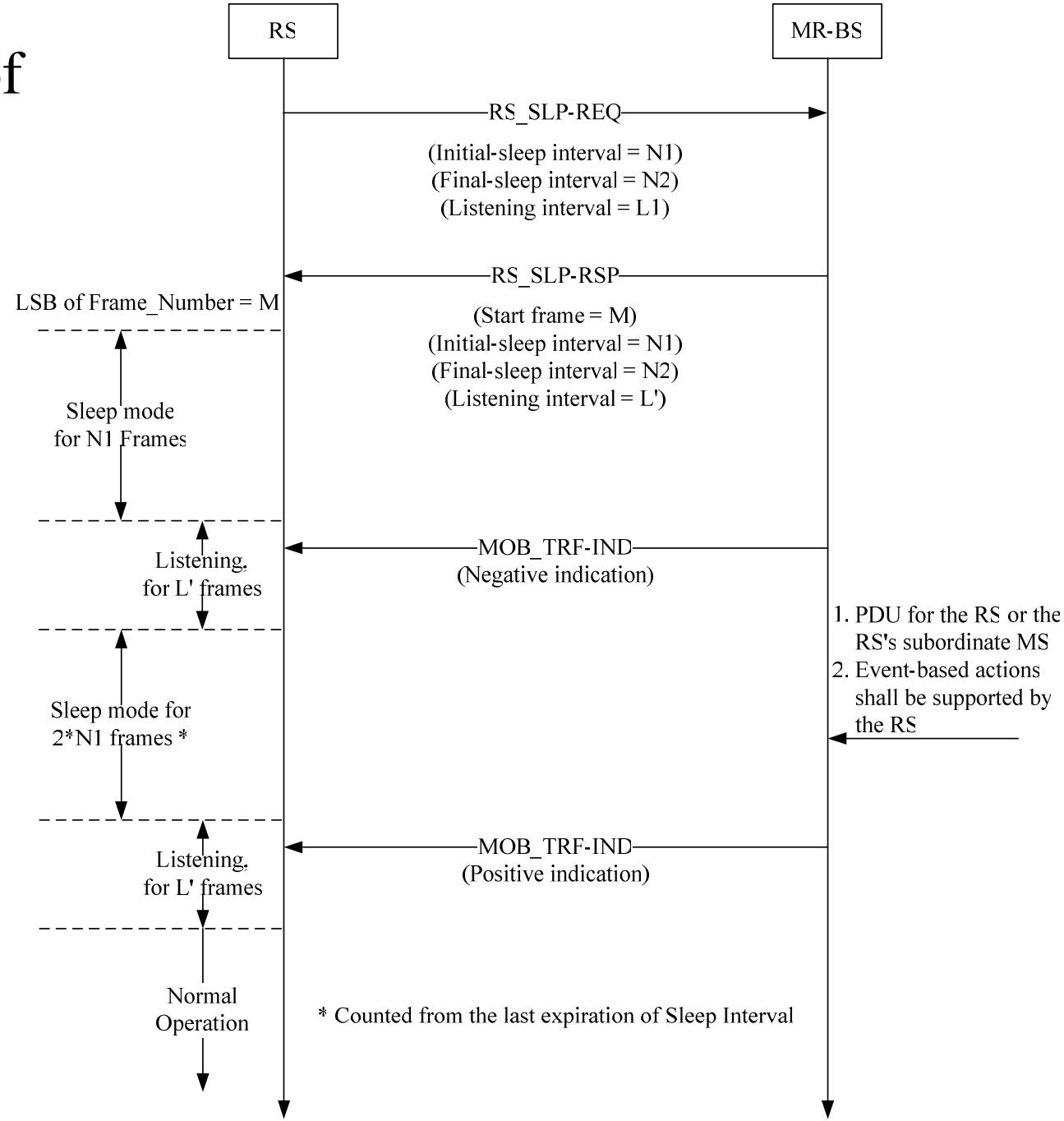
Ex 2:



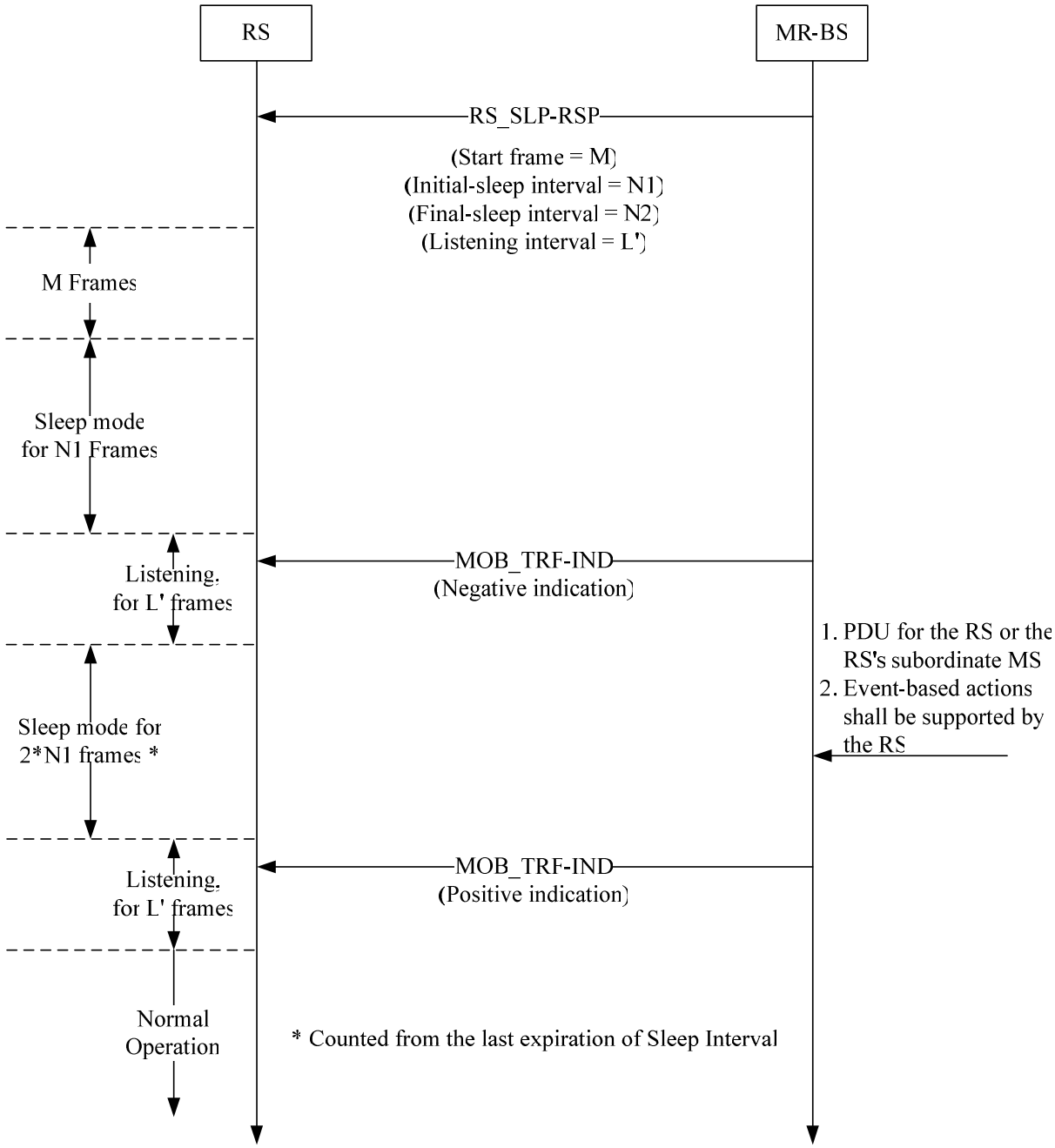
Conclusions

- 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