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Title	**Neighborhood Discovery and Measurement for Fixed/Nomadic RS in IEEE 802.16j Multi-hop Relay Network (harmonized with C802.16j-07/156r4)**
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Re:	IEEE 802.16j-07/007r2:“Call for Technical Comments and Contributions regarding IEEE Project 802.16j”
Abstract	This contribution proposes a neighborhood discovery/measurement mechanism and the corresponding message for fixed/nomadic RS in IEEE 802.16j MR network.
Purpose	For TG members to adopt the proposed messages and the supporting text into the IEEE 802.16j baseline document.
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Neighborhood Discovery and Measurement for Fixed/Nomadic RS in IEEE 802.16j Multi-hop Relay Network

This contribution proposes an RS neighborhood discovery/measurement mechanism for fixed/nomadic RS in IEEE 802.16j Multi-hop Relay network. Based on this proposal, MR-BS will instruct the RSs to transmit the RS-amble in the relay zone at the designated time when necessary. Then the RSs will report its neighbor discovery/measurement results to MR-BS. When fixed/nomadic RSs are deployed in the MR network, this mechanism may not be initiated very often. The overhead can be saved by preventing unnecessary RS-amble transmission in relay zone.

I. The concept of the proposed neighborhood discovery/measurement mechanism

According to the IEEE 802.16j frame structure, an RS neighborhood discovery mechanism is proposed here to synchronize the RS-amble transmission and measurement for RS and MR-BS in relay zone, which is shown in Figure 1. Figure 1(a) represents an example of the messaging procedure, and Figure 1(b) illustrates the way to synchronize the start point of each station. Figure 1(c) represents the flexibility it can perform. In order to

support this RS neighborhood discovery operation, the corresponding message design will be proposed in next section.

In Figure 1(a), the MR-BS sends the multicast message RS_NBR-MEAS-REQ to the RSs, where the RS_1, RS_2 and RS_3 are within the multicast group in this example. In this message, the 8 LSB bits is used to identify the serial number of the frame where the amble transmission and measurement procedure is initiated. The N_Transmitter and N_Receiver_RS will instruct the RSs with the subsequent Amble Indexes to transmit or receive the amble. N_Transmitter=2 and N_Receiver_RS=1 in Figure 1(a) respectively, which means the first two Amble Indexes after the parameter 'N_Receiver_RS' are instructing the RSs to transmit its amble, and the subsequent one Amble Index is instructing RS with this index to receive. Therefore, the amble transmission and measurement can be synchronized to the same time as shown in Figure 1(b).

In the proposed RS_NBR-MEAS-REQ message, the OFDMA Symbol Offset will be removed if the amble transmitted by each RS in relay zone will be fixed all the time. For the station being instructed to receive (i.e. RS_3 in this example), it shall scan the amble transmitted over each segment at the designated OFDMA symbol time. In addition, this message can instruct the amble repetition and continuous measurement opportunities in multiple frames by setting the Measurement Duration, Interleaving Interval and Measurement Iteration, which is shown in Figure 1(c).

After the measurement, the RS shall report the measurement results associated to those amble indexes of transmitter RSs by the RS_NBR-MEAS-REP message. The measurement results can be either RSSI or CINR, which depends on the instruction by RS_NBR-MEAS-REQ.

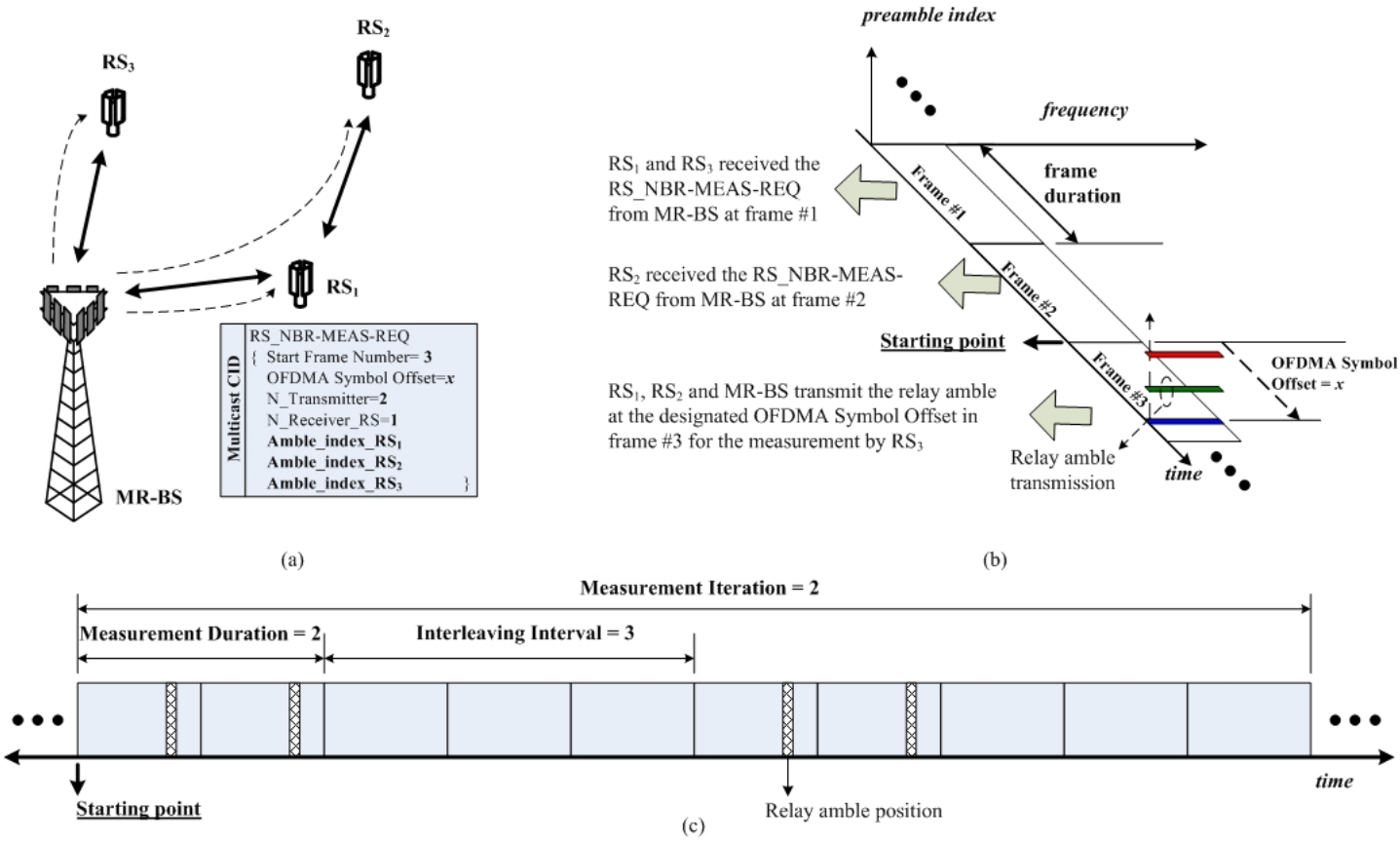

Fig.1 Proposed measurement mechanism: (a) an example of messaging procedure, (b) the position for RS-amble transmission and (c) the layout of the measurement opportunities

Moreover, the proposed mechanism can also be applied for the measurement across different MR-cell. In

Figure 2, the RS_1 and RS_2 are located in different MR-cell and be instructed to transmit and receive the amble respectively. The frame index used in each cell is usually different, therefore, the 8 LSB bits Start Frame Number sent by each cell may be different. In order to ensure the transmission and reception time will be aligned across different cell, a network coordinator may be needed to record the offset between the frame number indexes used in each cell. Since each MR-cell is synchronized with each other, the offset between each cell will be fixed. Therefore, the coordinator can instruct each MR-BS to compose the RS_NBR-MEAS-REQ message with the corresponding Start Frame Number which will align at the same time.

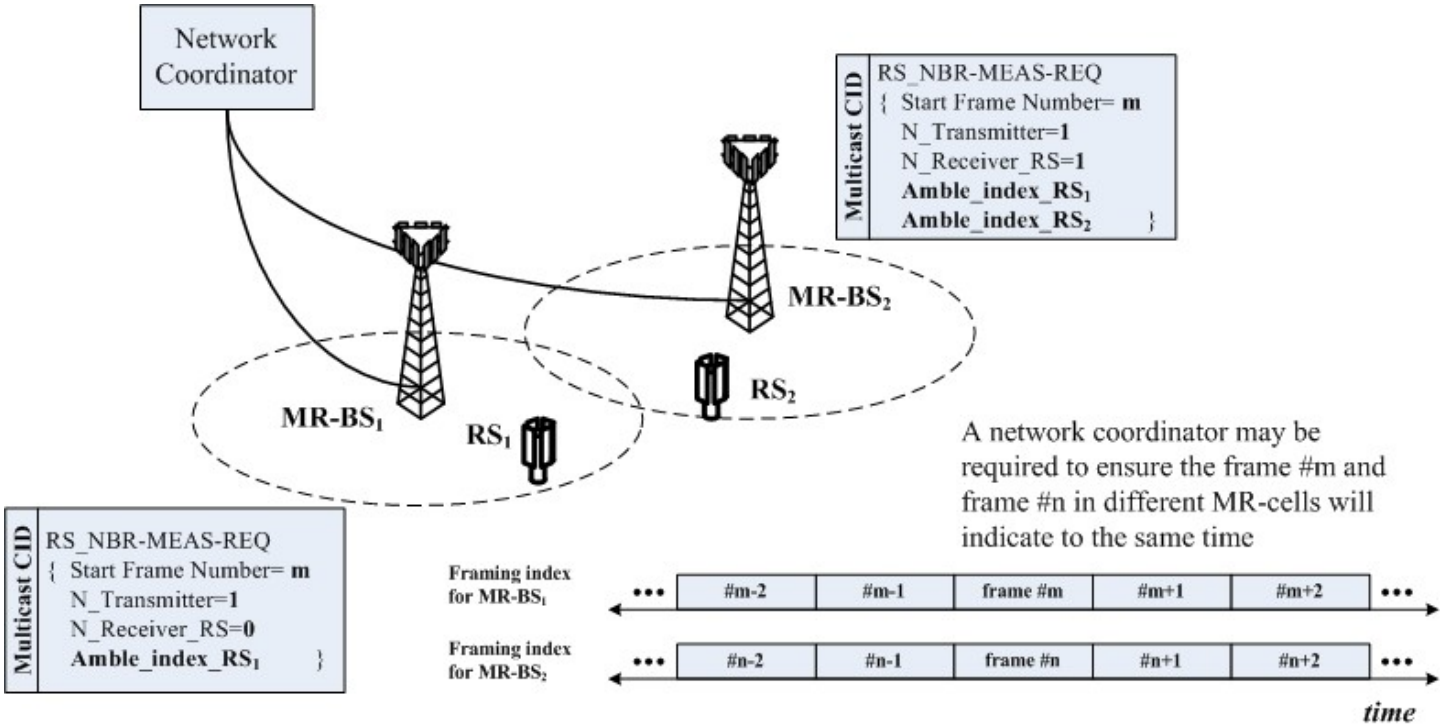

Fig.2 A network coordinator can be used to ensure the amble transmission and measurement will aligned to the same time

According to this mechanism, the MR-BS can compose the neighbor list of MOB_NBR-ADV based on the measurement results. In addition, the MR network can also predict the radio link quality in advance of allocating (reusing) the radio resources or reconfiguring its network topology based on this measurement results, so that the network management can be performed in an automatic manner.

II. Text proposal

----------Start of the text----------

Insert new subclause (6.3.2.3.62)

6.3.2.3.65 RS configuration request (RS_Config-REQ) message

The MR-BS can send a RS_Config-REQ message to instruct the RSs to transmit or receive the R-amble in

relay zone. This message can be sent by either unicast, multicast or broadcast CID of the RSs. An 8 LSB bits of the frame number index will indicate the starting point of the subsequent R-amble transmission/reception opportunities. In order to instruct the stations in different MR-cell to transmit/receive the R-ambles at the same time, a coordinator in backhaul network is needed to ensure the Start Frame Number in the message sent by different MR-BSs will align to the same time.

When the Prefix is set as "00", the RS shall follow the pattern instructed by MR-BS to transmit/receive the R-amble in relay zone. The pattern is composed by the amble index, and the RS shall transmit/receive the R-amble according to the field where its amble index is. The transmission opportunities are identified by Duration and Interleaving Interval for each iteration. An example is given in Figure x, where the Duration = 2, Interleaving Interval = 3 and the Iteration = 2. When the Iteration is more than one, the pattern for each iteration will be carried in this message. After the last iteration, the RSs shall report the measurement results by RS_NBR-MEAS-REP message defined in 6.3.2.3.63.

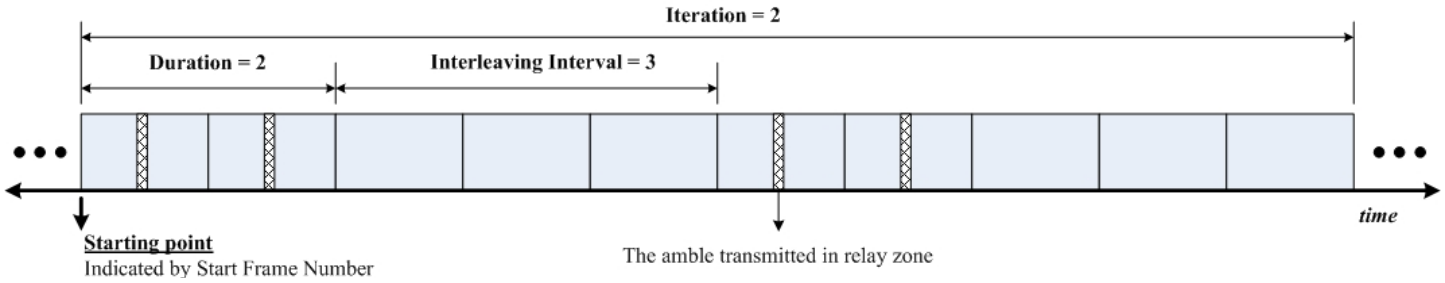

Figure x – Instructing the R-amble transmission in relay zone by RS_NBR-MEAS-REQ

If the Prefix is set "01", the RS will autonomously transmit/receive the R-amble in relay zone without periodic instruction from MR-BS. The detail design of the associated parameters is stated in 6.3.x.x. The RS is instructed to report its measurement results if the Prefix is set as "10". When the RS is instructed to transmit/receive the R-amble transmission autonomously, MR-BS can instruct the RS to report its measurement results by this message with the prefix set as "10".

R-amblefrom the consecutive R-amble transmission/reception opportunity. If the Duration value is set to 0x00 and prefix is 0b01 monitoring is to be continued until further notice the consecutive R-amble transmission/reception opportunitysinstructed R-ambleinstructed R-ambleR-amble transmitted in relay zoneR-ambleSynchronization Cycle LengthThis field is used to indicate the synchronization R-amble period if present Synchronization Frame OffsetThe offset of the second R-amble in the synchronization cycle

Neighbor Monitoring Frame Repetition RateThis field is used to indicate the neighbor monitoring R-amble period if present

Neighbor Monitoring Frame OffsetThe offset of the R-amble in the neighbor monitoring cycle

Neighbor Monitoring Cycle LengthThis defines the number of neighbor monitoring amble frames in an R-amble monitoring cycle66 66 and the existing RSs in MR network need to perform measurement over the new RSConfigeither , or unicast CID shall be set The Prefix shall be set “00” and attach the transmit/receive pattern for each iteration.follow the instruction to /receiveR-ambles in each iterationsRSSI or CINRNote that this mechanism can also be applied to the RSs during normal operation. So that the R-amble can be transmitted in relay zone when necessary. but transmitted by the same radio resource