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Re:	This is a response to Call for Technical Proposals regarding IEEE Project P802.16j.	
Abstract	The document contains technical proposals for IEEE P802.16j that would provide an MS channel measurement and its report in RS.	
Purpose	The document is submitted for review by 802.16 Working Group members.	
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MS Channel Detection of RS in Relay System

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ETRI

1. Introduction

All the radio resources are allocated by the MMR-BS and resource allocation information is broadcasted to all the RSs and MSs. When the MS moves around within cell coverage, the MMS-BS should estimate the radio channel of the MS. To minimize the used radio resource for sending the data to the MS, the MMR-BS shall select RSs that relay the data and are located near the MS. The relay path to the MS is calculated and known to the MMR-BS. The MS has a limit of maximum power transmission in uplink. It's appropriate that the uplink path is established by the MS via the RS near the MS. The channel information about the MS shall be known to the MMR-BS.

The MS starts ranging procedures in which the CDMA code is transmitted. The RNG-RSP message adjusts transmission parameters to maintain good communication quality between the MS and the target, either RS or MMR-BS. The CDMA code has no information about the MS involved in the ranging procedure. This adjustment of transmission parameters is done in the MS whose identifier is not known to the MMR-BS because the CDMA code does not identify the MS. When selecting the relay path, the MMR-BS utilizes the local information.

After the network entry procedure, the fixed RS within cell coverage makes a relay operation between entities. Before the MMR-BS allocates the radio resource in which the RS sends or receives the data, it's important that the MMR-BS gets information about radio channel between entities. The measurement of the radio channels either between RSs or between the RS and the MMR-BS is required before the MMR-BS selects a path between the MMR-BS and the RS. Given the RS, the MMR-BS has a path selection algorithm and can determine an optimal path that is calculated from the measurements of radio channels.

When the MS moves around within cell coverage, the measurements of the radio channel from the MS to either the RS or the MMR-BS shall be known to the MMR-BS for the purpose of resource allocation. The MS only can receive the downlink frames that do not have information about RS identification. That is, there is no explicit procedure that the MS informs the MMR-BS of the measurements of the radio channel to RS or MMR-BS.

2. Proposed Solution

When the MS sends fast feedback channel or PHY burst in uplink, it is required that the RSs measure its unicast data and send the measurement information to the MMR-BS. The reported information is utilized to estimate the radio channel between the MS and the RS. Figure 1 shows the RS Measurement Report (RM-RPT) message for the RS to send the received information to the MMR BS.

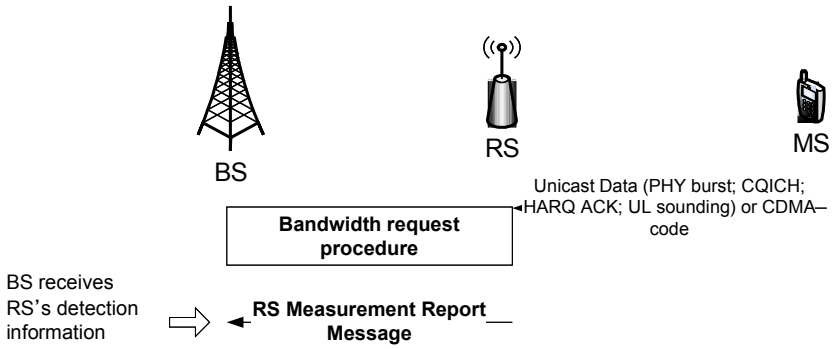

Figure 1 RS Measurement Report (RM-RPT) message.

How does the RS get the uplink allocation information used for measuring the received signals from the MSs? This contribution proposes that the UL-MAP is utilized for getting the uplink allocation information. This approach does not require additional signaling overhead for the MMR-BS to notify the allocation information to the RS. Receiving UL-MAP and extracting uplink allocation information, the RS measures the received signals transmitted by the MSs. The measured value are filtered and sent by the RS. The thresholds are used for filtering the measured values and are broadcasted in the UCD messages. Figure 2 shows automatic measurement and filtering operation for the uplink allocation specified by the UL-MAP.

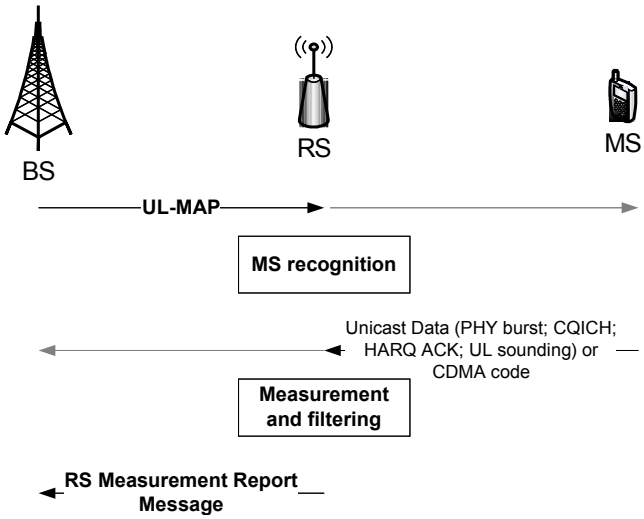

Figure 2 MAP-triggered measurement and fi tering.

This filtering of the measurements is to reduce the number of report events. Figure 3 shows the thresholds that define the range of the measured value. The RS shall maintain the information about MSs including the measured values on the radio channels and the history of measurement reports during a interval. When the measurement value of the MS is in the different range compared to the range at previous report of the MS, the RS shall send the RM-RPT message to the MMR-BS and inform the MMR-BS of the change of the range so that the MMR-BS uses this updated channel information. The thresholds describing the ranges of measurement value are specified by "RS measurement report thresholds", which is to minimize the number of report events.

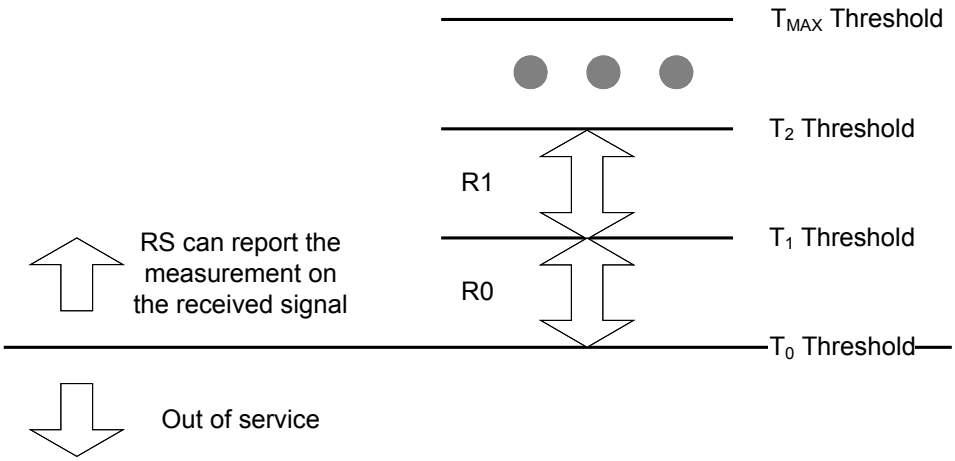

Figure 3 MS measurement report thresholds.

For an example, Figure 4 shows three reports from RSs for the MS. RS_1 and RS_2 report information that the received signal from the MS is in the range R_1. Based-on the reported information RS_1 and RS_2 can receive unicast data transmitted by the MS and relay it to the MMR-BS with established relay paths. That is, the MMR-BS selects RS_1 and RS_2 as relaying entities near the MS.

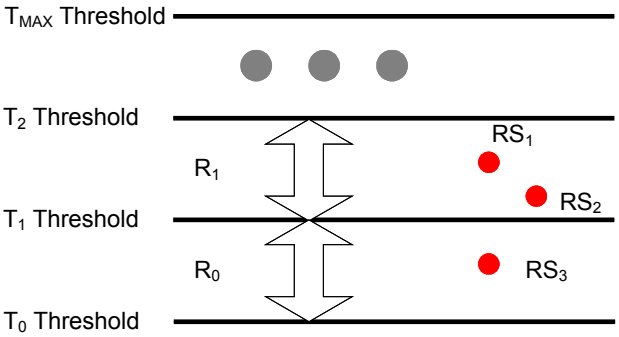

Figure 4 MS measurement report thresholds.

To maintain good communication quality between the RS and the MS, the MS should adjust communication parameters in conjunction with the RS's receiving timing. This requires that the RS sends the adjustment parameters to the MMR-BS. The MMR-BS sends adjustment parameters to the MS. The RNG-RPT message can be sent to give the MMR-BS the detected information about CDMA codes on the ranging region in uplink.

The BS intends to control the RS for the measurement. When the MS moves to the other BS or disconnects, the RS shall stop sending the measurement of the absent MS. The measurement information for the specified MS can be sent by the RS periodically or once by the request of the MMR-BS. The RS Measurement Control Request (RMC-REQ) message and the RS Measurement Control Response (RMC-RSP) message are exchanged for those purposes.

Text Proposals

[Insert the text after 6.3.2.3.61:]

6.3.2.3.62 RS Measurement Report (RM-RPT) message

If the RS is required to report channel measurements, it shall send the RS Measurement Report (RM-RPT) message in the form shown in Table aaa to the MMR-BS.

Table aaa- RM-RPT format

Name	Length	Value (Variable-length)
RM-RPT_Message_Format() {		
Management Message Type = (? 70)	8 bits	
Frame Number	8 bits	8 LSB of the frame number
N_Reports	8 bits	
For (i=0; i< N_Reports; i++) {		
Report indicator	8 bit	Bit #0: Report target type 0b0: Basic CID 0b1: Ranging CDMA code Bit #2-#1: Report value type 0b00: No report value 0b01: Threshold Index 0b10: Measured CINR 0b11: Reserved Bit #3: Timing adjust Bit #4: Power level adjust Bit #5: Offset frequency adjust Bit #6-#7: Reserved
If (Report target type == 0) {		
Basic CID	16 bits	
} else {		
Ranging code attributes	32 bits	Bits #31-#22: Used to indicate the OFDM time symbol reference that was used to transmit the ranging code. Bits #21-#16: Used to indicate the OFDMA subchannel reference that was used to transmit the ranging code. Bits #15-#8: Used to indicate the ranging code index that was sent by the MS. Bits #7-#0: The 8 least significant bits of the frame number of the OFDMA frame where the MS sent the ranging code.
}		
If (Report value type == 0b01) {		
Threshold Index	8 bits	The index of the field, "RS measurement report thresholds", that the measured CINR value is in the

		range from the threshold value of this index to the threshold value of next index.
} else if (Report value type == 0b10) {		
CINR	8 bits	Signed integer, in units of 0.25dB.
}		
If (Timing adjust == 1) {		
Timing adjust value	8 bits	Tx timing offset adjustment (signed integer). Units are PHY Specific (see 10.2).
}		
If (Power level adjust == 1) {		
Power level adjust value	8 bits	Tx Power offset adjustment in units of 0.25 dB (signed integer).
}		
If (Offset frequency adjust == 1) {		
Offset Frequency Adjust	32 bits	Tx Frequency offset adjustment in units of Hz (signed integer).
}		
}		
TLV Encoding Information	variable	TLV specific
}		

An RS shall generate RM-RPT messages in the form shown in Table aaa, including the following parameters:

CID (in the generic MAC header)

RS's Basic CID.

Frame Number

8 LSB of the frame number in which this message is transmitted by the RS.

The following parameters shall be included in the RM-RPT message:

N_Report

The number of report elements that the RS sends to the MMR-BS.

Report indicator

Bitmap indicator of report fields that the RS reports.

Bit #0: Report target type. If 0, the target is the MS with "Basic CID", and if 1, the target is the ranging code with "Ranging code attributes".

Bit #2-#1: Report value type. If the value is set to zero, there is no report value. If 0b01, the RS shall report the measurements in form of "Threshold index" and if 0b10, the RS shall inform the MMR-BS of CINR.

Bit #3: Timing adjust indicator.

Bit #4: Power level adjust indicator.

Bit #5: Offset frequency adjust indicator.

Bit #6-#7: Reserved.

According to "Report indicator" that the RS indicates, the RM-RPT message includes the followings:

Basic CID

Basic CID allocated to the MS.

Ranging code attributes

Identifies the ranging CDMA code specified by frame number, OFDM time symbol reference, Ranging Subchannel,

and ranging CDMA code index.

Threshold index

This is an index of "RS measurement report thresholds". The CINR of received signal from the MS with Basic CID is in the range from the threshold value of "RS measurement report thresholds" indexed by "Threshold index" to the threshold value indexed by next index, "Threshold index" plus one. 0xff means that the RS cannot maintain the communication link to the MS.

CINR

This parameters indicates the CINR measured by RS from the MS. It shall be interpreted as a signed value in units of 0.25 dB.

Timing adjust value

Tx timing offset adjustment of the MS. The amount of time required to adjust MS transmission so the burst will arrive at the expected time instance at the RS. This means that the MS shall advance its burst transmission time if the value is negative and delay its burst transmission if the value is positive. The BS uses this value when adjusting timing offset of MS.

Power level adjust value

Tx power offset adjustment of the MS. The value specifies the power level change in order that MS's transmissions arrive at the desired level at the RS.

Offset frequency adjust value

Tx frequency offset adjustment of the MS. The value specifies the relative change in transmission frequency of the MS in order to better match the RS.

The RM-RPT message shall contain the following:

HMAC Tuple (see 11.1.2)

The HMAC Tuple attribute contains a keyed message digest (to authenticate the sender). The HMAC Tuple attribute shall be the final attribute in this message's attriute list.

6.3.2.3.63 RS Measurement Control Request (RMC-REQ) message

The MMR-BS sends the RMC-REQ message in the form of Table bbb to the RS. This message forces the RS to control RS's measurement operations.

Table bbb- RMC-REQ format

Name	Length	Value (Variable-length)
RMC-REQ_Message_Format() {		
_Management Message Type = (? 70)	8 bits	
_Transaction ID	16 bits	
_N_Report_Control	8 bits	
_For (i=0; i< N_Report_Control; i++) {		
__Basic CID	16 bits	
__Report control mode	2 bit	0b00: Report now 0b01: Periodic reports

		0b10: Abort periodic reports 0b11: Delete
Reserved	6 bits	Shall be set to zero
If (Report periodically == 1) {		
Report Duration	16 bits	Unsigned integer in units of frames. When Duration is set to zero, there is no time limit of periodic report to the MS. The RS shall report periodically during Duration.
Report Period	16 bits	Unsigned integer in units of frames. The RS shall report periodically the measurements of received signal to the MMR-BS.
}		
}		
TLV Encoding Information	Variable	TLV specific
}		

An RS shall generate RMC-REQ messages in the form shown in Table bbb, including the following parameters:

CID (in the generic MAC header)

RS's Basic CID.

Transaction ID

Unique identifier for this transaction assigned by the sender

The following parameters shall be included in the RMC-REQ message:

N_Report_Control

The number of report controls that the MMR-BS forces the RS to report as indicated.

Basic CID

Basic CID allocated to the MS.

Report control mode

Action code for a RS's report on measurements of received signal from the MS.

0b00: The RS sends the RM-RPT message with the measurement of the MS immediately.

0b01: The RS sends the RM-RPT message with the measurement of the MS periodically.

0b10: The RS terminates periodic report operation of the MS.

0b11: When the MS is removed in the BS, the BS forces the RS to remove the MS from the MS list of channel measurement.

According to "Report control mode" that the BS indicates, the RMC-REQ message includes the followings:

Report Duration

The RS reports periodically the measurements of the signal from the MS in the time described by Duration. If Duration is set to zero, the time duration is not specified and the RS shall report periodically until terminating periodic reports by receiving the RMC-REQ message of either "Aborting periodic reports" or "Delete".

Report Period

The period of RS's report when the RS is required to report the measurements for received signal from the MS.

periodically.

The RMC-REQ message shall contain the following:

HMAC Tuple (see 11.1.2)

The HMAC Tuple attribute contains a keyed message digest (to authenticate the sender). The HMAC Tuple attribute shall be the final attribute in this message's attribute list.

6.3.2.3.64 RS Measurement Control Response (RMC-RSP) message

The RS shall send the RMC-RSP message in response to a received RMC-REQ message.

Table ccc- RMC-RSP format

Name	Length	Value (Variable-length)
RMC-RSP_Message_Format() {		
_Management Message Type = (? 70)	8 bits	
_Transaction ID	16 bits	
_Confirmation Code	8 bits	
_TLV Encoding Information	variable	TLV specific
}		

An RS shall generate RMC-RSP messages in the form shown in Table ccc, including the following parameters:

CID (in the generic MAC header)

RS's Basic CID.

Transaction ID

Transaction ID from corresponding RMC-REQ message.

Confirmation Code

The appropriate Confirmation Code (CC) for the corresponding RMC-REQ message.

The RMC-RSP message shall contain the following:

HMAC Tuple (see 11.1.2)

The HMAC Tuple attribute contains a keyed message digest (to authenticate the sender). The HMAC Tuple attribute shall be the final attribute in this message's attriute list.

[Insert the following entries into table 353-UCD PHY-specific channel encodings-WirelessMAN-OFDMA:]

Name	Type (bytes)	Length	Value
RS measurement information maintain time	???	2	Maximum time, in units of seconds, in which the RS maintains the source information without measuring any received signal from the source.
RS measurement report thresholds	???	Variable	This is a list of signed integer numbers, where each number is encoded by one byte. The values are sorted in increasing order. The number encoded by each byte represents the signed threshold value in

			normalized C/N of received signal, in units of 0.5dB. The RS can start to report the measurement of the MS only when the received signal is greater than the first threshold.

[Insert the text at 6.3.10.3.4:]

6.3.10.3.4.1 MS ranging

The MS shall follow the transmission and receipt operations of MS's ranging procedures in section (6.3.10.3.1, 6.3.10.3.2, and 6.3.10.3.3).

When the RS receives the CDMA code sent by the MS, it gets adjustment information about time, power, and offset frequency that are required to maintain the communication quality between the RS and the MS. The RM-RPT message is sent by the RS that reports the detected CDMA code and its adjustments. The RM-RPT message may include the report elements, in which "Report target type" is set to "Ranging CDMA code" and "Ranging code attributes" specifies the CDMA code identified by frame number, OFDM time symbol reference, Ranging Subchannel, and ranging CDMA code index. The RS shall send this code information to the MMR-BS as fast as possible within the required maximum time that the MS can receive the response of the CDMA code within the specified time, T3. The RS shall discard the received CDMA code information that cannot be sent by the RS to the MMR-BS.

All the RSs of receiving the CDMA code may send the RM-RPT message, including the report element of the detected CDMA code and its adjustments, to the MMR-BS. Because the MMR-BS can receive multiple reports on the CDMA code from several RSs, the transmission of RNG-RSP message in response to the CDMA code is held until the MS can wait for receiving the response message within the specified time, T3. The MMR-BS shall select an appropriate AS, which is either MMR-BS or RS, among the ASs receiving the CDMA code. The MMR-BS broadcasts the RNG-RSP message that contains the "Ranging code attributes" and adjustment parameters, which are required to maintain good communication quality between the selected RS and the MS.

[Insert the text after 6.3.25:]

6.3.25.1 MS channel measurement triggered by MAP

The RS shall receive the MAP message which includes all the resource allocations to the MSs. All the received signals of uplink unicast data sent by the MSs shall be measured according to the information about uplink resource allocations. The RS shall maintain the information about MSs including the measured values on the radio channels and the history of measurement reports during a interval. When the measurement value of the MS is in the different range compared to the range at previous report of the MS, the RS shall send the RM-RPT message to the MMR-BS and inform of the change of the range so that the MMR-BS uses this updated channel information. The thresholds describing the ranges of measurement value are specified by "RS measurement report thresholds", which is to minimize the number of report events. Figure ??? shows RS's measurement operation and its report event. The RM-RPT message includes the report element that "Basic CID" and "Threshold index" identify the MS and the range of the measured value, respectively. Additionally, the adjustment information about time, power, and offset frequency may be sent

to maintain the communication quality between the RS and the MS.

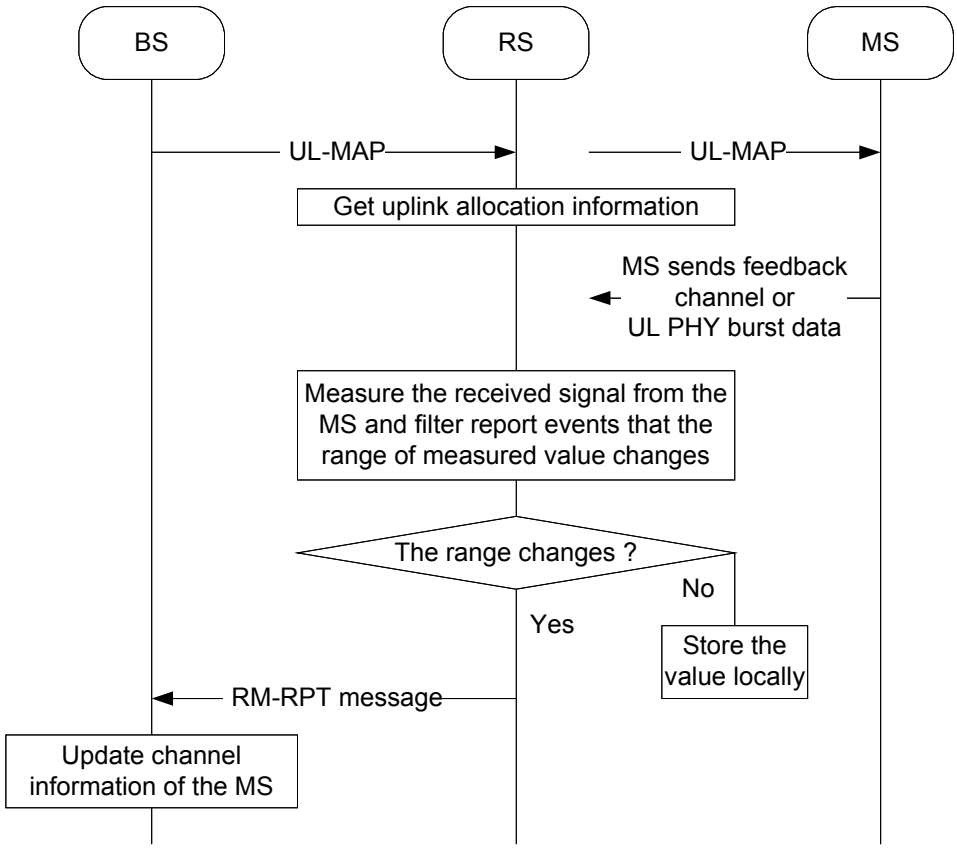

Figure ??? – MAP-triggered measurement and threshold-based report.

If the MMR-BS intends to control RS's measurement of received signals from the selected MS, it sends the RMC-REQ message to the RS and the RMC-RSP message is sent by the RS in response to the RMC-REQ message. For the MS specified by Basic CID, the MMR-BS can get the measured values once or periodically receiving the RM-RPT message.