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| Project | **IEEE 802.16 Broadband Wireless Access Working Group <**<http://ieee802.org/16>**>** | |
| Title | **Forwarding Procedure for Talk-around Direct Communication** | |
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| Re: | “IEEE 802.16-12-400-00-Gdoc,” in response to Letter Ballot Recirc #38b on P802.16.1a/D3 | |
| Abstract | This provides AWD text proposals for forwarding procedure for Talk-around Direct Communication in IEEE p802.16.1a/D3. | |
| Purpose | To discuss and adopt the proposed text in the draft amendment document on GRIDMAN | |
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**Forwarding procedure for Talk-around Direct Communication**

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ETRI

# Introduction

General description and functions of HR-MS Forwarding to Network using talk-around communication is described in 6.12.3 and 6.12.3.3. According to the 6.12.3.3, an HR-BS shall maintain a list of HR-MSs which are connected to a forwarding HR-MS and broadcasts them to forwarding HR-MSs using an AAI-DC-MM-ADV message and the forwarding HR-MS updates the list of HR-MSs using an AAI-DC-LU-REQ/RSP message. In addition, the message fields of those messages are not described yet.

In this contribution, we propose MAC control messages for HR-MS Forwarding to network using talk-around communication without a list management of HR-MSs connected to forwarding HR-MSs in an HR-BS.

A forwarding HR-MS negotiates forwarding to network capabilities for talk-around communication with an HR-BS then advertises the capabilities as a forwarding HR-MS to forwarded HR-MSs on a talk-around direct communication link.

There are two types of connection supported by a forwarding HR-MS. One is a one-way unicast transport connection from a forwarding HR-MS to an HR-BS. The other is a one-way multicast transport connection from an HR-BS to a forwarding HR-MS.

A forwarding HR-MS generates control signaling for an HR-BS on behalf of a forwarded HR-MS and manages the mapping between a direct communication group identifier and an infra-structure address. It translates direct communication applications into infra-structure based applications. The details of translation between applications are out of scope of this standard.

This contribution proposes how HR-MS forwarding to network using talk-around communication works as the followings:

* Capability as a forwarding HR-MS on an SBC message between a forwarding HR-MS and an HR-BS
* Advertising information of a forwarding HR-MS
* Forwarding Connection establishment
* Forwarding Connection release
* Resource allocation for a Forwarding HR-MS

# References

[1] IEEE P802.16nTM/D3, Air Interface for Broadband Wireless Access Systems - Draft Amendment: Higher Reliability Networks, April 2012.

[2] IEEE P802.16.1aTM/D3, WirelessMAN-Advanced Air Interface for Broadband Access Systems - Draft Amendment: Higher Reliability Networks, April 2012.

[3] EEE P802.16Rev3/D4, IEEE Draft Standard for Local and metropolitan area networks; Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems,” February 2012.

[4] IEEE P802.16.1TM/D4, IEEE Draft for WirelessMAN-Advanced Air Interface for Broadband Wireless Access Systems, February 2012.

# Proposed Text for P802.16.1a/D3

Note:

The text in **BLACK** color: the existing text in the 802.16.1a Draft Standard Text

The text in **~~RED~~** color: the removal of existing 802.16.1a Draft Standard Text

The text in **BLUE** color: the new text added to the 802.16.1a Draft Standard Text

[-------------------------------------------------Start of Text Proposal---------------------------------------------------]

**[*Remedy1: Adopt the following change in Section 6.2.3 in IEEE P802.16.1a/D3*]**

***[Page# 7, Line# 8~]***

**6.2.3 MAC control messages**

***Change Table 29 as indicated:***

Table 29 —MAC control messages

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| No. | Functional Areas | Message names | Message description | Security | Connection |
| ~~105~~ | ~~Talk-around direct communication~~ | ~~AAI-DC-MM-ADV~~ | ~~MS list Advertisement~~ |  | ~~Broadcast or multicast or unicast~~ |
| ~~106~~ | ~~Talk-around direct communication~~ | ~~AAI-DC-LU-REQ~~ | ~~MS List Update Request~~ |  | ~~Unicast~~ |
| ~~107~~ | ~~Talk-around direct communication~~ | ~~AAI-DC-LU-RSP~~ | ~~MS List Update Response~~ |  | ~~Unicast~~ |
| **105** | **Talk-around direct communication** | **AAI-DC-FWD-ADV** | **Advertisement of Forwarding HR-MS** |  | **Broadcast** |
| **106** | **Talk-around direct communication** | **AAI-DC-FWD-JOIN** | **HR-MS Group Join** |  | **Unicast** |
| **~~108~~107** | BS-controlled HR-MS  forwarding to network | AAI-FN-CONFIG-CMD | Forwarding to network  configuration |  | Unicast or  Multicast |
| **~~109~~ 108** | BS-controlled HR-MS forwarding to network | AAI-FN-RNG-ACK | Acknowledging successful receiving of raging preamble by forwarding HR-MS |  | Broadcast (toward new HR-MS that is carrying out network entry through the forwarding HR-MS) |
| **~~110~~ 109** | BS-controlled HR-MS forwarding to network | AAI-FN-RNG-REP | Forwarding HR-MS report to serving HR-BS/RS the reception of ranging signal from new HR-MS | Encrypted/ICV | Unicast |
| **~~111~~ 110** | BS-controlled HR-MS forwarding to network | AAI-FN-RNG-FLU | HR-BS/RS selects one or group of HR-MS to follow-up with the ranging process of new HR-MS |  | multicast |
| **~~112~~** **111** | Standalone | AAI-SA-BPAG-ADV | Blind Page Advertisement Message |  | Broadcast |
| **~~113~~ 112** | Standalone | AAI-SA-BPAG-ACK | Blind Page ACK message |  | Unicast |
| **~~114~~** **113** | Multicast | AAI-HR-MG-IND | Multicast Group Indication Message |  | Broadcast |
| **~~115~~** **114** | Multicast | AAI-HR-MT-IND | Multicast Traffic Indication Message |  | Broadcast or Multicast |
|  |  |  |  |  |  |

**[*Remedy2: Adopt the following change in Section 6.2.3.5 to Section 6.2.3.6 in IEEE P802.16.1a/D3.*]**

***[Page# 25, Line# 1]***

* + - 1. AAI-SBC-REQ

An AAI-SBC-REQ message, to which HARQ operation is applied, is transmitted by AMS to negotiate basic capability during network entry.

***Change Table 31 as indicated:***

1. —AAI-SBC-REQ message field description

| **Field** | **Size (bits)** | **Value/Description** | **Condition** |
| --- | --- | --- | --- |
| …… |  |  |  |
| If (HR-RS is the sender of AAI-SBC-REQ) { |  |  |  |
| Local Forwarding Capability | 2 | 0b00: LF is not supported  0b01: HR-RS detects LF opportunity and performs LF  0b10: HR-RS does not detect LF opportunity but can perform LF  0b11: reserved | Present if needed in HR Network |
| } |  |  |  |
|  |  |  |  |
| **Talk Around Direct Communication Forwarding Capability supported** | **1** | **0x0 : the capability as a Forwarding HR-MS is not supported**  **0x1 : the capability as a Forwarding HR-MS is supported** | **Present during the network entry procedure of HR-MS having the capability of Talk-around Direct Communication** |
| **For (i=0; i<N\_Slot; i++){** |  | **N\_Slot is the number of direct mode slots in the Talk-around Direct Communication frame structure to prevent an HR-BS from allocating the corresponding subframes for the HR-MS in order to support forwarding to the network**  **N\_Slot Range is 1..8** | **Present if Direct Communication Forwarding Capability supported == 1** |
| **Direct Mode Zone Type** | **2** | **Direct mode zone type for preventing an HR-BS from allocating downlink or uplink subframes**  **0x0: Common direct mode zone (CDMZ)**  **0x1: Common direct mode zone extended**  **(CDMZ-E)**  **0x2: Cell specific direct mode zone (CSDMZ)**  **0x3: Reserved.** |  |
| **Direct Mode Slot Number prohibiting resource allocation** | **1** | **Slot Number in the Talk-around Direct Communication frame structure to prevent an HR-BS from allocation of the infra-structure resources for the corresponding subframes for the HR-MS**  **0x0 : Slot 1**  **0x1 : Slot 2** |  |
| **}** |  |  |  |
|  |  |  |  |

* + - 1. AAI-SBC-RSP

***Insert the following new rows at the end of Table 32:***

1. —AAI-SBC-RSP message field description

| **Field** | **Size**  **(bits)** | **Value/Description** | **Conditions** |
| --- | --- | --- | --- |
| … | … | … | … |
| Local Forwarding Capability | 2 | 0b00: LF is not allowed  0b01: HR-BS detects LF opportunity and HR-RS performs LF as needed  0b10: HR-RS detects LF opportunity and HR-RS performs LF as needed  0b11: ASN detects LF opportunity and HR-RS performs LF as needed | Present if needed in HR Network |
| **Talk Around Direct Communication Forwarding Capability supported** | **1** | **0x0 : The capability as a Forwarding HR-MS is not supported**  **0x1 : The capability as a forwarding HR-MS is supported** | **Present during the network entry procedure of HR-MS having the capability of Talk-around Direct Communication** |
| **For (i=0; i<N\_Slot; i++){** |  | **N\_Slot is the number of direct mode slots in the Talk-around Direct Communication frame structure to prevent an HR-BS from allocating the corresponding subframes for the HR-MS in order to support forwarding to the network**  **N\_Slot Range is 1..8** | **Present if Direct Communication Forwarding Capability supported == 1** |
| **Direct Mode Zone Type** | **2** | **Direct mode zone type for preventing an HR-BS from allocating downlink or uplink subframes**  **0x0: Common direct mode zone (CDMZ)**  **0x1: Common direct mode zone extended**  **(CDMZ-E)**  **0x2: Cell specific direct mode zone (CSDMZ)**  **0x3: Reserved.** |  |
| **Direct Mode Slot Number prohibiting resource allocation** | **1** | **Slot Number in the Talk-around Direct Communication frame structure to prevent an HR-BS from allocation of the infra-structure resources for the corresponding subframes for the HR-MS**  **0x0 : Slot 1**  **0x1 : Slot 2** |  |
| **}** |  |  |  |

**[*Remedy3: Adopt the following change from Section 6.2.3.65.21 in IEEE P802.16.1a/D3.*]**

***[Page# 70, Line#64]***

* + - * 1. AAI-DC-LEST-REQ

An HR-MS transmits a AAI-DC-LEST-REQ message to establish a**n** one way peer-to-peer TDC link.

Table 106a – AAI-DC-LEST-REQ message field description

| **Field** | **Size (bits)** | **Value/Description** | **Condition** |
| --- | --- | --- | --- |
| Link Change Count | 4 | The change count of this transaction assigned by the sender. If new transaction is started, Link Change Count is incremented by one (modulo 16) by the sender. | Shall always be present |
| For (i=0; i<N\_Flow\_Est; i++) { |  | N\_Flow\_Est is the number of flows on which the sender of this message sends MAC PDUs.  Range [0..1] |  |
| FID | 4 | Flow identifier assigned by the ~~sink~~ **source station** of packets on the flow |  |
| Traffic Priority | 3 | 0 to 7: Higher numbers indicate higher priority  Default: 0 |  |
| CS Specification Parameters | 8 | 0–15: *Reserved*  16: Voice Codec G.729A  17: Voice Codec AMR  18–255: *Reserved* |  |
| MAC Header Type | 1 | Indicates whether AGMH or SPMH is presented at the start of MAC PDUs of the service flow.  0 : AGMH (Advanced Generic MAC Header)  1 : SPMH (Short-Packet MAC header)  default value is 0. |  |
| } |  |  |  |
| **Forwarding Request Indicator** | **1** | **Indicate that an HR-MS requests forwarding to network**  **0b0: Not request forwarding to network**  **0b1: Request forwarding to network** |  |
| **Target DCGID** | **24** | **DC Group Identifier.**  **Indicate that the target address for forwarding to network** |  |
| *Reserved* | **2** |  |  |

**[*Remedy4: Adopt the following change from Section 6.2.3.65.48 to Section 6.2.3.65.50 in IEEE P802.16.1a/D3.*]**

***[Page# 92, Line# 2]***

* + - * 1. ~~AAI-DC-MM-ADV~~

~~An HR-BS transmits an AAI-DC-MM-ADV message to advertise an MS list for HR-MS forwarding.~~

* + - * 1. ~~AAI-DC-LU-REQ~~

~~A forwarding HR-MS transmits an AAI-DC-LU-REQ message to update a MS list for HR-MS forwarding.~~

* + - * 1. ~~AAI-DC-LU-RSP~~

~~An HR-BS transmits a AAI-DC-LU-RSP message in response to a received AAI-DC-LU-REQ.~~

6.2.3.65.48 AAI-DC-FWD-ADV

**A forwarding HR-MS transmits an AAI-DC-FWD-ADV message to advertise status of forwarding link between HR-BS and HR-MSs which are not connected to the infra-structure.**

Table xx - AAI-DC-FWD-ADV message field description

| **Field** | **Size (bits)** | **Value/Description** | **Condition** |
| --- | --- | --- | --- |
| **Forwarding DCTID** | **24** | **DC Terminal Identifier.**  **Indicates the HR-MS which forwards the direct communication data between HR-BS and HR-MSs which are not connected to the infra-structure** | **Shall always be present** |
| **For (i=0; i<N\_Candidate\_DCGID; i++) {** |  | **N\_Candidate\_DCGID is the number of group services which can be served by the forwarding HR-MS**  **Range [0..36]** |  |
| **Candidate DCGID** | **24** | **DC Group Identifier.**  **Indicate a DC Group list which can be supported by the forwarding HR-MS** |  |
| } |  |  |  |
| **For (i=0; i<N\_On-Going\_DCGID; i++) {** |  | **N\_On-Going\_DCGID is the number of on-going group services which is served by the forwarding HR-MS**  **Range [0..36]** |  |
| **On-Going DCGID** | **24** | **DC Group Identifier.**  **Indicate a DC Group list which is currently served by the forwarding HR-MS** |  |
| **}** |  |  |  |
| **Forwarding Unicast Status** | **1** | **Indicate if a forwarding HR-MS is available for forwarding unicast services toward HR-BS or not**  **0x0: available**  **0x1: currently forwarding packets** |  |
| **Message Change Count** | **4** | **Message Change Count from the corresponding AAI-FWD-ADV** | ?? |
| **Reserved** | **2** |  |  |

6.2.3.65.49 AAI-DC-FWD-JOIN

**AN HR-MS which is not connected to an HR-BS transmits an AAI-DC-FWD-JOIN message to a forwarding HR-MS to notify a list of DCGIDs which are subscribed by the HR-MS. The list of DCGIDs should not be in the list of On-Going DCGID of an AAI-DC-FWD-ADV message.**

Table xx - AAI-DC-FWD-JOIN message field description

| **Field** | **Size (bits)** | **Value/Description** | **Condition** |
| --- | --- | --- | --- |
| **For (i=0; i<N\_DCGID; i++) {** |  | **N\_DCGID is the number of Group identifier which are subscribed by an HR-MS, but are not in the on-going DCGID of AAI-DC-FWD-ADV**  **Range [0..36]** |  |
| **DCGID** | **24** | **DC Group Identifier.** |  |
| } |  |  |  |

**[*Remedy5: Adopt the following change from Section 6.12.3 in IEEE P802.16.1a/D3.*]**

***[Page# 160, Line#12]***

**6.12.3 Support for HR-MS forwarding to network**

**6.12.3.1 General description**

In HR-MS Forwarding to Network, an HR-MS forwards user data and control signaling between an HR-MS and an HR infra-structure station. The user data and control signaling do not go through higher layer at the forwarding HR-MS. The origination and termination of the user data and control signaling are at the forwarded HR-MS and the HR infra-structure station respectively and vice versa.

HR-MS Forwarding to Network is applicable when 1) the forwarded HR-MS and the forwarding HR-MS are in coverage of and directly associated to an infra-structure station; 2) the forwarding HR-MS is in coverage of and directly associated to an HR infra-structure station, while the forwarded HR-MS is out of coverage of any HR infra-structure stations.

BS-controlled HR-MS forwarding to network is described in 6.12.3.2.

~~Using talk-around direct communication described in 6.12.2.3, HR-MS forwarding to network is described in 6.12.3.3~~.

**[*Remedy6:Remove Section 6.12.3.3 in IEEE P802.16.1a/D3.*]**

***[Page# 184, Line# 12]***

* + - 1. ~~Talk-around HR-MS forwarding to network~~
         1. ~~Medium access control~~

~~6.12.3.3.1.1 HR-MS discoveries~~

~~A forwarding HR-MS shall maintain a list of HR-MSs that are in communication range using talk-around direct communication.~~

~~An HR-BS shall maintain a list of HR-MSs that are collected from forwarding HR-MSs for HR-MS forwarding. An HR-BS broadcast the HR-MS list for HR-MS forwarding to forwarding HR-MSs using AAI-DC-MM-ADV message. When new HR-MS is added or HR-MSs are deleted, the forwarding HR-MS shall update the HR-MS list by an exchange of MAC Management messages with HR-BS such as AAI-DC-LU-REQ/RSP.~~

~~Forwarding connection management~~

~~A unicast forwarding connection between HR-BS and forwarding HR-MS is a unicast transport connection established to forward data traffic in one-way from HR-BS to forwarding HR-MS or vice versa.~~

~~A multicast forwarding connection between HR-BS and forwarding HR-MS is a multicast transport connection established to forward data traffic in one-way from HR-BS to forwarding HR-MSs.~~

~~Each unicast or multicast forwarding connection, which is established for supporting HR-MS forwarding, carries forwarding data packets. When HR-BS sends data packets on a unicast or multicast forwarding connection, forwarding HR-MS discriminates the data packets with type of transport connection and forwards the data packets on a direct communication link. When a forwarding HR-MS receives data packets on a direct communication link, the forwarding HR-MS discriminates the data packets and forwards the data packets on a unicast forwarding connection toward HR-BS.~~

~~Forwarding connection establishment~~

~~When a forwarding HR-MS is requested to establish a forwarding connection from HR-MSs out of BS’s coverage, the forwarding HR-BS establishes a unicast or multicast forwarding connection. The unicast or multicast forwarding connection between HR-BS and forwarding HR-MS is established by exchanges of MAC Management messages such as AAI-DSA-REQ/RSP/ACK.~~

~~Forwarding connection release~~

~~The forwarding connection is terminated with forwarding connection release. On forwarding connection release, the context of forwarding connection are removed at both HR-BS and forwarding HR-MSs.~~

~~An HR-BS and a forwarding HR-MS release a unicast or multicast forwarding connection by exchanges of MAC Management messages such as AAI-DSD-REQ/RSP/ACK.~~

~~QoS management~~

~~QoS concept of forwarding connections shall be the same as described as in section 6.2.12 with the exception of QoS described in this section.~~

* + - * 1. ~~Physical layer~~

**[*Remedy7:Insert Section 6.12.2.3.1.13 in IEEE P802.16.1a/D3.*]**

***[Page# 139, Line# 17]***

**6.12.2.3.1.13 Talk-around HR-MS forwarding to network**

**In talk-around HR-MS forwarding to networks, a forwarding HR-MS is in the coverage of an HR-BS and forwards traffic to or from HR-MSs which are out of coverage of an HR-BS.**

**A forwarding HR-MS generates control signaling for an HR-BS on behalf of a forwarded HR-MS and manages the mapping between DCGID and the infra-structure address. It translates DC applications into infra-structure based applications. The details of translation between applications are out of scope of this standard.**

**6.12.2.1.13.1 Advertising a forwarding HR-MS**

**A forwarding HR-MS broadcasts its information on a TDC link within a duration T*forwardingadv* using an AAI-DC-FWD-ADV message. In addition, it broadcasts an AAI-DC-FWD-ADV message with an increased message change count whenever its information is changed.**

**Upon receiving an AAI-DC-FWD-ADV message, an HR-MS maintains the list of candidate and on-going DCGIDs in order to use an HR infra-structure service in the outside of HR-BS coverage.**

**If DCGIDs subscribed by an HR-MS are on the on-going DCGID list, it waits for the control message (AAI-DC-LEST-CMD) and data. If they are not on the list but on the candidate DCGIDs, the HR-MS requests forwarding data from a forwarding HR-MS by sending an AAI-DC-FWD-JOIN message.**

**An HR-MS may send an AAI-DC-LEST-REQ message to a forwarding HR-MS in order to create a DC connection for forwarding to network when the Forwarding Unicast Status is ‘available’ in the previous AAI-DC-FWD-ADV message.**

**6.12.2.1.13.2 Forwarding connection management**

**A unicast forwarding connection between an HR-BS and a forwarding HR-MS is a unicast transport connection established to forward data traffic in one-way from a forwarding HR-MS to an HR-BS.**

**A multicast forwarding connection between an HR-BS and a forwarding HR-MS is a multicast transport connection established to forward data traffic in one-way from an HR-BS to a forwarding HR-MSs.**

**Each unicast or multicast forwarding connection, which is established for supporting HR-MS forwarding, carries forwarding data packets. When an HR-BS sends data packets on multicast forwarding connections, a forwarding HR-MS discriminates the data packets and forwards the data packets on a direct communication link. When a forwarding HR-MS receives data packets on a unicast direct communication link, the forwarding HR-MS discriminates the data packets and forwards the data packets on a unicast forwarding connection toward an HR-BS.**

**6.12.2.1.13.3 Forwarding connection establishment**

**When an HR-MS out of BS’s coverage needs to send packets to any infra-structure node, it request a forwarding HR-MS to establish a one-way unicast TDC link by sending an AAI-DC-LEST-REQ message if Forwarding Unicast Status is ‘available’ in the previous AAI-DC-FWD-ADV message. In the AAI-DC-LEST-REQ message, the HR-MS specifies the target DC Group address with which it communicates then the forwarding HR-MS translates the target DC Group address to an address used in the infra-structure and requests a unicast forwarding connection for the target address. It receives an AAI-DC-LEST-RSP message from the forwarding HR-MS in response to the AAI-DC-LEST-REQ. After the one-way unicast TDC link is established, the forwarding HR-MS broadcasts a AAI-DC-FWD-ADV with Forwarding Unicast Status == 1.**

**When a forwarding HR-MS is requested to establish a forwarding multicast connection triggered by an AAI-DC-FWD-JOIN message with target DC Group addresses from an HR-MS out of BS’s coverage, the forwarding HR-MS establishes a multicast forwarding connection for the target group address from an HR-BS to a forwarding HR-MS. The forwarding HR-MS translates the target DC Group address to an address used in the infra-structure. If the forwarding multicast connection is established, the forwarding HR-MS broadcasts a AAI-DC-FWD-ADV with new on-going DCGIDs. The HR-MS outside of BS coverage is received both a preamble and an AAI-DC-LEST-CMD message to establish a one-way multicast link.**

**The unicast or multicast forwarding connection between an HR-BS and a forwarding HR-MS is established by exchanges of MAC Management messages such as AAI-DSA-REQ/RSP/ACK.**

**6.12.2.1.13.4 Forwarding connection release**

**The forwarding connection is terminated with forwarding connection release. On forwarding connection release, the context of forwarding connection are removed at both HR-BS and forwarding HR-MSs.**

**If a forwarding HR-MS is not received any supplementary channels on unicast or multicast TDC links, it may release the connection.**

**An HR-BS and a forwarding HR-MS release a unicast or multicast forwarding connection by exchanges of MAC Management messages such as AAI-DSD-REQ/RSP/ACK.**

**6.12.2.1.13.5 QoS management**

**QoS concept of forwarding connections shall be the same as described as in section 6.2.12 with the exception of QoS described in this section.**

**6.12.2.1.13.6 Resource allocation for forwarding**

**A forwarding HR-MS has the ability of sending or receiving both on infra-structure resources and on talk-around direct communication resources. However, the forwarding HR-MS during talk-around direct communication could not send or receive control and data using infra-structure resources. The forwarding HR-MS negotiates with an HR-BS for designated resources of the talk-around direct communication. Then the HR-BS does not allocate the resources.**

**The forwarding HR-MS may not send infra-structure data to an HR-BS and talk-around direct communication data to an HR-MS at the same uplink subframe because of power limits.**

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[----------------------------------------------End of Text Proposal----------------------------------------------]