

IEEE Standard for WirelessMAN-Advanced Air Interface for Broadband Wireless Access Systems

Amendment 1: Enhancements to Support Machine-to-Machine Applications

IEEE Computer Society
and the
IEEE Microwave Theory and Techniques Society

Sponsored by the
LAN/MAN Standards Committee

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IEEE Standard for WirelessMAN-Advanced Air Interface for Broadband Wireless Access Systems

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Approved 30 August 2012
IEEE-SA Standards Board

Abstract: Enhancements to the WirelessMAN-Advanced Air Interface, an air interface designated as “IMT-Advanced” by the International Telecommunication Union—Radiocommunication Sector (ITU-R), are specified in this standard. Improved support for machine-to-machine applications are provided by these enhancements.

Keywords: broadband wireless access, IEEE 802.16, IEEE 802.16.1, IEEE 802.16.1b, IMT-Advanced radio interface, machine to machine (M2M), mobile broadband, orthogonal frequency-division multiple access (OFDMA), WirelessMAN®-Advanced Air Interface, wireless metropolitan area networks

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Introduction

This introduction is not part of IEEE Std 802.16.1b-2012, IEEE Standard for WirelessMAN-Advanced Air Interface for Broadband Wireless Access Systems—Amendment 1: Enhancements to Support Machine-to-Machine Applications.

This amendment specifies enhancements to the WirelessMAN-Advanced Air Interface, an air interface designated as “IMT-Advanced” by the International Telecommunication Union—Radiocommunication Sector (ITU-R). The enhancements provide improved support for machine-to-machine applications. As of the approval date, the applicable version of IEEE Std 802.16.1 is IEEE Std 802.16.1-2012, as amended by IEEE 802.16.1b-2012.

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1. Overview

Insert new subclause 1.5:

1.5 Support for Machine-to-Machine (M2M) communications

The M2M communication is referred to as the information exchange between devices through a base station, or between a device and a server in the core network through a base station that may be carried out without any human interaction.

M2M communications is a very distinct capability that enables the implementation of the “Internet of things.”

Some of the typical use cases that the M2M communication enables are secured access and surveillance, tracking and tracing, public safety, payment, health care, remote maintenance and control, metering, consumer devices, and retailing.

In order to enable a range of Machine-to-Machine applications in which the device communications require wide area wireless coverage in licensed bands, and are automated rather than human-initiated or human-controlled for purposes such as observation and control, some MAC protocols and PHY specifications have been changed for enhancement. MAC enhancements and minimal PHY modifications include support of lower power consumption at the device, support by the base station of significantly larger numbers of devices, efficient support of small burst transmission, and improved device authentication.

3. Definitions

Insert the following definitions in alphabetical order:

Machine-to-Machine (M2M) communication: Information exchange between user devices through a Base Station, or between a device and a server in the core network through a Base Station that may be carried out without any human interaction.

M2M ASN: An Access Service Network that supports M2M service.

M2M device: An MS that is capable of providing M2M communication.

M2M feature: A unique characteristic of an M2M application.

M2M device group: A group of M2M devices that share one or more features in common.

6. WirelessMAN-Advanced Air Interface

6.2 Medium access control

6.2.1 Addressing

6.2.1.2 Logical identifiers

6.2.1.2.1 Station identifier (STID)

Insert the following text at the end of the first paragraph of 6.2.1.2.1:

The STID is also used to identify the M2M devices in the domain of the ABS. The ABS may assign the same STID to multiple M2M devices.

If the assigned STID to an M2M device is shared with other M2M device(s), the ABS shall assign the frame(s) in which the STID is valid for an M2M device. The assigned STID to an M2M device is valid only in the frame (i.e., $Frame_{num}$) that satisfies the following condition:

$$Frame_{num} \bmod STID-Valid-Periodicity = STID-Valid-Offset$$

where $Frame_{num}$ denotes the frame sequence number. The parameters *STID-Valid-Periodicity* and *STID-Valid-Offset* are transmitted by the ABS in the AAI-REG-RSP message. For the M2M devices sharing the same STID, their *STID-Valid-Periodicity* values shall be identical, and their *STID-Valid-Offset* values shall be unique.

Insert new subclause 6.2.1.3 as indicated:

6.2.1.3 Address for machine-to-machine application

Insert new subclause 6.2.1.3.1 as indicated:

6.2.1.3.1 M2M Group Identifier (MGID)

An M2M Group Zone is a logical zone comprising multiple ABSs. An M2M Group Zone is identified by M2M-GROUP-ZONE-ID. M2M-GROUP-ZONE-ID is broadcasted in the AAI-SCD message if the M2M feature is supported by an ABS. MGID is a 12-bit value that uniquely identifies a downlink multicast service flow shared by a group of M2M devices within an M2M Group Zone.

M2M Group Zone Indexes are defined as localized indexes assigned to M2M Group Zones of an ABS. For a given MGID and M2M-GROUP-ZONE-ID assigned to an M2M device, the M2M Group Zone index is dependent on the ABS with which the M2M device is communicating. The M2M device shall derive the M2M Group Zone index corresponding to the assigned M2M-GROUP-ZONE-ID before receiving the MAC control message addressed by the ABS using the MGID.

An M2M device derives the M2M-Group-Zone-Index corresponding to an M2M-GROUP-ZONE-ID based on the implicit ordering of the M2M-GROUP-ZONE-IDs in the AAI-SCD message. The M2M-Group-Zone-Index of the first included M2M-GROUP-ZONE-ID in the broadcast message is assigned to be 0 and increases sequentially until $(MAX_M2M_Group_Zone - 1)$, where the Maximum number of M2M Group Zones ($MAX_M2M_Group_Zone$) supported by an ABS is defined to be 4. Hence, when the ABS is part of only one M2M Group Zone, it broadcasts only one M2M-GROUP-ZONE-ID and the M2M device derives the corresponding M2M-Group-Zone-Index as 0b00. An M2M device group is addressed using the MGID

and the corresponding M2M-Group-Zone-Index. All MGIDs that are assigned to an M2M device belong to the same M2M Group Zone. When an M2M device changes its preferred ABS or S-ABS, it shall derive the M2M-Group-Zone-Index corresponding to the M2M Group Zone for the new ABS.

An MGID is assigned to a multicast service flow of an M2M device by a network entity after initial network entry through a DSA procedure and is released during an explicit network exit or when the M2M device enters the DCR mode. The assigned MGID shall be retained by an M2M device even in idle mode unless the M2M device exits from the network or the network explicitly deletes the service flow associated with the MGID. An M2M device may be assigned multiple MGIDs, each for a different multicast service flow. The MGID may be re-assigned during the Connected State and the idle mode. During the Connected State, the MGID may be changed, and deleted, by the DSC and the DSD procedure, respectively.

During the idle mode, the MGID may be changed by location update or network reentry. When the ABS changes the MGID of all M2M devices within the multicast group, the ABS may trigger the group location update via paging message. When the M2M device performs the timer-based location update, if the ABS needs to update the MGID of M2M device, the AAI-RNG-RSP message with new MGID is sent by the ABS in response to the AAI-RNG-REQ message.

An ABS may use AAI-PAG-ADV to indicate the update of MGID and its new value to all the M2M devices in a group. When an idle mode M2M device that belongs to the M2M device group (identified by its MGID) receives a paging message directed to its MGID and the Action Code is set to 0b11, this M2M device shall update its MGID based on the new MGID value indicated.

After receiving the AAI-PAG-ADV message that contains a new MGID, the M2M device shall send the AAI-RNG-REQ message with ranging purpose indication set to 0b0011 (idle mode location update) and MGID acknowledgment indication to acknowledge the reception of the AAI-PAG-ADV message. If the ABS does not receive the acknowledgment from some of the M2M devices belonging to that M2M device group in which MGID was updated, it assumes that those M2M devices missed the MGID update information. In the next paging cycle, the ABS may ask those M2M devices to perform a location update to acquire the new MGID value through the AAI-RNG-RSP message.

The ABS may use the M2M device group MAC Control (AAI-MGMC) message with the MGID to send the information to multiple M2M devices. The M2M device shall respond to acknowledge this message with the AAI-MSG-ACK message defined in 6.2.3.36.

The information of the neighboring M2M Group Zones may be advertised by ABSs of a given M2M Group Zone in the AAI-NBR-ADV message. Neighboring M2M Group Zones implies the M2M Group Zones that neighboring ABSs belong to that are different from the M2M Group Zones that the S-ABS belongs to.

The AAI-NBR-ADV message contains M2M-GROUP-ZONE-ID of the neighboring M2M Group Zones along with the mappings of MGID from an M2M Group Zone of the S-ABS to one or more neighboring M2M Group Zones. When an M2M device changes its preferred ABS or S-ABS to an ABS that belongs to a different M2M Group Zone than the current S-ABS, it may have the MGID mapping information for the M2M Zones of the preferred ABS and can derive M2M-Group-Zone-Index corresponding to M2M-GROUP-ZONE-IDs supported by the preferred ABS, if it has already received the AAI-NBR-ADV message. The ordering of M2M-GROUP-ZONE-IDs of a neighbor ABS reported in the AAI-NBR-ADV message follows the ordering of the M2M-GROUP-ZONE-IDs in the AAI-SCD message broadcasted by the neighboring ABS.

The AAI-NBR-ADV message including M2M Group Zone information may only be transmitted by the ABSs that are situated at the M2M Group Zone boundaries.

Insert new subclause 6.2.1.3.2 as indicated:

6.2.1.3.2 Fixed M2M Deregistration ID (FMDID)

A 16-bit value that uniquely identifies a fixed M2M device in the domain of the ABS. An FMDID is assigned to a fixed M2M device by an ABS during idle mode entry and released during the network reentry. The ABS may assign a new FMDID to a fixed M2M device during a location update procedure.

6.2.2 MAC PDU formats

6.2.2.1.3 MAC signaling header

Change the contents of Table 6-5 as indicated:

Table 6-5—Type field encodings for MAC signaling header type

Type field (5 bits)	MAC signaling header type
00000	BR with STID
00001	BR without STID
00010	Service specific scheduling control header
00011	Sleep control
00100	AMS battery level report
00101	Uplink power status report
00110	Correlation matrix feedback
00111	MIMO feedback
01000	Grant Management
<u>01001</u>	<u>M2M Bandwidth request (BR) with STID header</u>
<u>01010</u>	<u>M2M abnormal power down report</u>
<u>01011</u>	<u>M2M abnormal power down confirmation</u>
~~01001~~ <u>01100</u> –11111	<i>Reserved</i>

Insert new subclause 6.2.2.1.3.10:

6.2.2.1.3.10 M2M Bandwidth request (BR) with STID header

When an M2M device requests bandwidth through an UL resource allocated by the CDMA Allocation A-MAP IE, it shall transmit M2M BR with STID signaling header on the allocated UL resource if the *STID-Valid-Offset* is assigned to it. Otherwise it shall transmit BR with STID signaling header. M2M BR with STID header format is defined in Table 6-15a.

Table 6-15a—M2M BR with STID header format

Syntax	Size (bits)	Notes
M2M BR with STID () {		
FID	4	Flow Identifier. Set to 0010.
Type	5	MAC signaling header type = 0b01001.
Length	3	Indicates the length of the signaling header in bytes.
BR Size	17	Aggregated bandwidth request size in bytes.
BR FID	4	The FID for which UL bandwidth is requested.
STID	12	STID of the M2M device that requests UL bandwidth.
STID-Valid-Offset	3	STID-Valid-Offset of the M2M device that requests UL bandwidth.
}		

Insert new subclause 6.2.2.1.3.11:

6.2.2.1.3.11 M2M abnormal power down report header

When an M2M device in the Connected State detects an abnormal power down event, it sends an M2M abnormal power down report signaling header indicating that an abnormal or involuntary power down has occurred. The M2M abnormal power down report signaling header is defined in Table 6-15b.

Table 6-15b—M2M abnormal power down report header format

Syntax	Size (bits)	Notes
M2M Abnormal Power Report Down Report () {		
FID	4	Flow Identifier. Set to 0b0010.
Type	5	MAC Signaling header type = 0b01010.
Length	3	Indicates the length of the signaling header in bytes.
STID	12	Indicates STID of the M2M device that transmits this M2M abnormal power down report signaling header.
STID-Valid-Offset	3	Indicates STID-Valid-Offset of the M2M device that sends this M2M abnormal power down report signaling header. If the assigned STID is not shared with other M2M devices, M2M device shall set this field to zero.
Emergency Type	1	0b0: power outage 0b1: <i>Reserved</i>

Table 6-15b—M2M abnormal power down report header format (continued)

Syntax	Size (bits)	Notes
EC	1	0: Unprotected 1: Protected using CMAC
If (EC == 1) {		
ROC	3	3 LSBs of Roll over counter (see 6.2.5.7 for details).
CMAC	16	CMAC (see 6.2.5.7 for details).
} else {		
<i>Reserved</i>	3	
}		
}		

Insert new subclause 6.2.2.1.3.12:

6.2.2.1.3.12 M2M abnormal power down confirmation header

An M2M abnormal power down confirmation signaling header shall be transmitted by the ABS in response to a received abnormal power down report. The M2M abnormal power down confirmation signaling header is defined in Table 6-15c.

Table 6-15c—M2M abnormal power down confirmation header format

Syntax	Size (bits)	Notes
M2M Abnormal Power Down Confirmation () {		
FID	4	Flow Identifier. Set to 0b0010.
Type	5	MAC Signaling header type = 0b01011.
Length	3	Indicates the length of the signaling header in bytes.
STID-Valid-Offset	3	Indicates STID-Valid-Offset of the M2M device in the received M2M abnormal power down report signaling header.
<i>Reserved</i>	1	<i>Reserved</i> . This field shall be set to zero.
}		

6.2.3 MAC Control messages

Change Table 6-28 as indicated:

Table 6-28—MAC Control messages

No.	Functional areas	Message names	Message description	Security	Connection
70	RELAY	AAI-ARS-CONFIG-CMD	ARS configuration Command	N/A	Unicast
71	<u>M2M</u>	<u>AAI-MTE-IND</u>	<u>M2M multicast transmission end indication</u>	<u>N/A: in broadcast</u> <u>Null: in multicast when multicast SA is not established</u> <u>Encrypted/ICV: in multicast when multicast SA is established</u>	<u>Broadcast/Multicast (using MGID)</u>
72	<u>M2M</u>	<u>AAI-MGMC</u>	<u>M2M device group MAC Control</u>	<u>N/A: in broadcast</u> <u>Null: in multicast when multicast SA is not established</u> <u>Encrypted/ICV: in multicast when multicast SA is established</u>	<u>Broadcast/Multicast (using MGID)</u>
<u>73–255</u>			<u>Reserved</u>		

6.2.3.1 AAI-RNG-REQ

Change Table 6-29 as indicated:

Table 6-29—AAI-RNG-REQ message field description

Field	Size (bits)	Value	Condition
Ranging Purpose Indication	4	0b0000 = Initial network entry 0b0001 = HO reentry 0b0010 = Network reentry from idle mode ... 0b1101 = NS/EP call setup 0b1110 = Network Reentry from idle mode of AMS which has entered idle mode in R1 BS 0b1111 = <u>Reserved Ranging Purpose Indicator Extension</u>	
<u>If (Ranging Purpose Indication == 0b1111) {</u>			
<u>Ranging Purpose Indicator Extension</u>	<u>3</u>	<u>0b000 = Abnormal power down</u> <u>0b001–0b111 = Reserved</u>	
<u>}</u>			
...	...		...

Table 6-29—AAI-RNG-REQ message field description (continued)

Field	Size (bits)	Value	Condition
} else if (Ranging Purpose Indication == 0b0010) {		// Network reentry from idle mode	
if (S-SFH Network Configuration bit == 0b1 or AMSID privacy is disabled){			
AMS MAC address	48	AMS's real MAC address	
} else {			
Deregistration Identifier (DID)	18	The ID that the AMS is assigned for idle mode and currently maintains.	<u>If the Localized-Idle-Mode-flag is set to 1 in the AAI-DREG-REQ/RSP message, DID shall not be included in this message.</u>
<u>Fixed M2M Deregistration ID (FMDID)</u>	<u>16</u>	<u>Used to indicate Fixed M2M Deregistration ID used to identify the fixed M2M device in idle mode $0..2^{16} - 1$</u>	<u>Shall be present if the Localized-Idle-Mode-flag is set to 1 in the AAI-DREG-REQ/RSP message.</u>
}			
<u>MFM-bitmap</u>	<u>2</u>	<u>Bitmap to indicate the MFM (MIMO Feedback Mode)s for which the M2M device is sending feedback as described in Table 6-223. Maximum of 2 distinct concurrent MFM are allowed with MFM-bitmap. LSB #0: MFM 0 LSB #1: MFM 4</u>	<u>Shall be present if MFM 0 or MFM 4 are supported by a fixed M2M device and an M2M device is configured to report MIMO feedback during network reentry.</u>
<u>If (LSB#0 in MFM-bitmap == 1){</u>			
<u>Wideband CQI</u>	<u>4</u>		
<u>Wideband STC rate</u>	<u>3</u>	<u>'STC rate - 1' mapped to 3-bit unsigned integer (i.e., STC rate = 1 as 0b000 ~ STC rate = 8 as 0b111)</u>	
<u>}</u>			
<u>If (LSB#1 in MFM-bitmap == 1){</u>			
<u>Wideband CQI</u>	<u>4</u>		
<u>Wideband STC</u>	<u>3</u>	<u>'STC rate - 1' mapped to 3-bit unsigned integer (i.e., STC rate = 1 as 0b000 ~ STC rate = 8 as 0b111)</u>	

Table 6-29—AAI-RNG-REQ message field description (continued)

Field	Size (bits)	Value	Condition
<u>Wideband PMI</u>	<u>6</u>	<u>Wideband preferred matrix index (PMI), size of which is number of PMI bits ('NB') used, mapped to NB LSB bits of this field, while the remaining MSB bit(s) is set to zero (0)</u>	
↓			
Paging Controller ID	48	The Paging Controller ID that the AMS currently maintains in idle mode.	<u>If the Localized-Idle-Mode-flag is set to 1 in the AAI-DREG-REQ/RSP message, Paging Controller ID shall not be included in this message.</u>
...			
<u>Bandwidth Request Size</u>	<u>11</u>	<u>Amount of bandwidth requested in bytes</u>	<u>Shall be present when M2M device that performs network reentry requests bandwidth for UL data to be transmitted after completion of the current network reentry.</u>
} else if (Ranging Purpose Indication == 0b0011 0b0110 0b0111 0b1011) {		// Idle mode location update (and with other additional purposes)	
...	...	...	...
<u>M2M short data burst encryption indicator</u>	<u>1</u>	<u>Indicate that the included M2M short data burst is encrypted.</u> <u>0b0: Not encrypted</u> <u>0b1: Encrypted</u>	<u>Shall be present if M2M device includes M2M short data burst in this message.</u>
<u>Current-M2M-GROUP-ZONE-ID</u>	<u>12</u>	<u>M2M-GROUP-ZONE-ID for the current MGID</u>	<u>Shall be present when an M2M device requests MGID update during location update or network reentry if the M2M device does not have the information of new M2M Group Zone.</u>
For ($i = 0; i < \text{Num-MGID}; i++$){			
<u>Current-MGID</u>	<u>12</u>	<u>Current MGID</u>	<u>Shall be present when an M2M device requests MGID update during location update or network reentry if the M2M device does not have the information of new M2M Group Zone.</u>
↓			

Table 6-29—AAI-RNG-REQ message field description (continued)

Field	Size (bits)	Value	Condition
<u>MGID acknowledgment indication</u>	1	<u>Indicate that new MGID was received successfully</u>	<u>Shall be present when the M2M device sends this message to acknowledge the reception of new MGID included in the AAI-PAG-ADV message.</u>
<u>}//end of Ranging Purpose Indication else if (Ranging Purpose Indication == 0b1111) {</u>			
<u>if (Ranging Purpose Indicator Extension == 0b000) {</u>		<u>//Abnormal or involuntary power down</u>	
<u>}</u>			
<u>}//end of Ranging Purpose Indication</u>			
...	...	...	...
<u>Retrials</u>	2	<u>The number of failed trials in this ranging process</u> <u>Bits 0–1: Indicates the number of retrials in the channel ranging access as follows:</u> <u>00:Success in the first attempt</u> <u>01:Success in the second attempt</u> <u>10:Success in the third attempt</u> <u>11:Success in the fourth or later attempt</u>	<u>Shall be present when an M2M device is configured to report statistics of initial ranging during network entry or reentry, periodic ranging, or HO ranging.</u>

6.2.3.2 AAI-RNG-RSP

Change Table 6-30 as indicated:

Table 6-30—AAI-RNG-RSP message field description

Field	Size (bits)	Value/Description	Condition
...		...	...
<u>Bandwidth grant indicator</u>	1	<u>0b0: Accept bandwidth request, and the M2M device does not need to do bandwidth request after network reentry</u> <u>0b1: Reject bandwidth request, and the M2M device needs to do bandwidth request after network reentry</u>	<u>Shall be included if AAI-RNG-RSP message is transmitted in response to the AAI-RNG-REQ message that includes bandwidth request size during network reentry from idle mode.</u>

Table 6-30—AAI-RNG-RSP message field description (continued)

Field	Size (bits)	Value/Description	Condition
<u>M2M-Group-Zone-Index</u>	<u>2</u>	<u>M2M-Group-Zone-Index of the corresponding M2M-GROUP-ZONE-ID that the New-MGID belongs to. It is derived based on the implicit ordering of the M2M-GROUP-ZONE-IDs in the AAI-SCD message transmitted by the ABS.</u>	<u>Shall be present when MGID needs to be updated during location update or network reentry (see 6.2.1.3.1) if the ABS is part of more than one M2M Group Zone.</u>
For ($i = 0; i < \text{Num-MGID}; i++$) {		<u>Number of MGID (Num-MGID) to update.</u>	<u>Shall be present if MGID needs to be updated (see 6.2.1.3.1).</u>
<u>Current-MGID</u>	<u>12</u>		
<u>New-MGID</u>	<u>12</u>		
<u>New-MGSS</u>	<u>64</u>		<u>Shall be included only in the encrypted AAI-RNG-REQ message when the MGID is updated.</u>
}			
...		...	...
If (Location Update Response == 0x0) {			
...	...	...	...
<u>New Fixed M2M Deregistration ID</u>	<u>16</u>	<u>New FMDID that the fixed M2M device shall maintain in idle mode.</u>	<u>Shall be present if the Localized-Idle-Mode-flag is set to 1 in the AAI-DREG-REQ/RSP message.</u>
...	...	...	...
}			
...	...	...	...

6.2.3.3 AAI-RNG-ACK

Insert the following text before Table 6-31:

For initial ranging of M2M groups, if the ABS receives a ranging preamble code dedicated for an M2M group and a ranging status of the detected ranging preamble code is equal to “success,” it does not include UL transmission parameter adjustments that correspond to the detected ranging preamble code in the AAI-RNG-ACK message.

6.2.3.8 AAI-REG-REQ

Change the contents of Table 6-36 as indicated:

Table 6-36—AAI-REG-REQ message field description

Field	Size (bits)	Value/Description	Condition
...	...	...	...
<u>Support of STID Sharing</u>	<u>1</u>	<u>0: STID sharing is not supported</u> <u>1: STID sharing is supported</u>	<u>Shall be included when an M2M device is performing initial network entry.</u>
<u>Ranging backoff mechanism</u>	<u>1</u>	<u>0b0: Indicates decreasing ranging backoff mechanism defined in 6.2.18.7.2 is supported</u> <u>0b1: Indicates decreasing ranging backoff mechanism defined in 6.2.18.7.2 is not supported</u>	<u>Shall be present when an M2M device is performing initial network entry.</u>

6.2.3.9 AAI-REG-RSP

Change the contents of Table 6-37 as indicated:

Table 6-37—AAI-REG-RSP message field description

Field	Size (bits)	Value/Description	Condition
...	...	...	...
<u>Support of STID Sharing</u>	<u>1</u>	<u>0: STID sharing is not supported</u> <u>1: STID sharing is supported</u>	<u>Shall be included when an M2M device is performing initial network entry.</u>
<u>STID-Valid-Periodicity</u>	<u>3</u>	<u>The STID-Valid-Periodicity together with STID-Valid-Offset indicates at which frames the assigned STID is valid for the M2M device</u>	<u>If support of STID sharing is supported by M2M device and the ABS, this parameter shall be included when an M2M device is performing initial network entry or an M2M device has no STID pre-assigned when it is performing a network reentry procedure (see 6.2.15).</u>

Table 6-37—AAI-REG-RSP message field description (continued)

Field	Size (bits)	Value/Description	Condition
<u>STID-Valid-Offset</u>	<u>3</u>	<u>The STID-Valid-Offset together with STID-Valid-Periodicity indicates at which frames the assigned STID is valid for the M2M device</u>	<u>If support of STID sharing is supported by M2M device and the ABS, this parameter shall be included when an M2M device is performing initial network entry or an M2M device has no STID pre-assigned when it is performing network reentry procedure (see 6.2.15).</u>
<u>Ranging backoff mechanism</u>	<u>1</u>	<u>0b0: Indicates decreasing ranging back-off mechanism defined in 6.2.18.7.2 is supported</u> <u>0b1: Indicates decreasing ranging back-off mechanism defined in 6.2.18.7.2 is not supported</u>	<u>Shall be present when an M2M device is performing initial network entry.</u>
<u>Indication of GD scheme</u>	<u>1</u>	<u>0b00: Not support GD scheme</u> <u>0b01: Support GD scheme</u>	<u>Present when an ABS supports an M2M feature.</u>

6.2.3.13 AAI-NBR-ADV

Change Table 6-41 as indicated:

Table 6-41—AAI-NBR-ADV message field description

Field	Size (bits)	Value/Description	Condition
...			
}//end of for N-NBR-ABSs			
<u>For ($j = 0; j < \text{N-NBR-ABSs}; j++$) {</u>		<u>N-NBR-ABSs denotes the number of neighboring ABSs [1..64].</u>	
<u>For ($n = 0; n < \text{N-M2M-GROUP-ZONE}; n++$) {</u>		<u>N-M2M-GROUP-ZONE denotes the number of M2M Group Zones that the neighbor ABS belongs to [1..4].</u>	<u>Shall be present when N-M2M-GROUP-ZONE > 1</u>
<u>M2M-GROUP-ZONE-ID</u>	<u>12</u>		
<u>1</u>			
<u>1</u>			
<u>For ($i = 0; i < \text{Num-M2M-Zones}; i++$) {</u>		<u>Num-M2M-Zones denotes the number of neighboring M2M Zones [1..4].</u>	
<u>M2M-GROUP-ZONE-ID</u>	<u>12</u>	<u>Denotes the neighbor M2M-GROUP-ZONE-ID.</u>	

Table 6-41—AAI-NBR-ADV message field description (continued)

Field	Size (bits)	Value/Description	Condition
For ($m = 0; m < \text{Num-MGID-Mapping}; m++$) {		<u>Num-MGID-Mapping is the number of mappings of current MGID and new MGID between the serving M2M Zone and the neighbor M2M Zone, where the current MGID is not the same as the new MGID [1..4096].</u>	<u>Shall be present when the mapping of M2M Service IDs to MGIDs is different in the neighboring M2M Zone</u>
<u>Current MGID to New MGID mapping</u>	24	<u>The 12 LSBs denote the MGID in current M2M Zone and the 12 MSBs denote the corresponding MGID in the associated neighboring M2M Zone.</u> <u>A value of 0 for 12 MSBs denotes that the associated service is not supported in the corresponding neighboring M2M Zone.</u>	
}			
}			
For ($i = 0; i < \text{N-NBR-R1-BSs}; i++$) {			

6.2.3.21 AAI-DREG-REQ message

Change Table 6-49 as indicated:

Table 6-49—AAI-DREG-REQ message field description

Field	Size (bits)	Value/Description	Condition
Deregistration_Request_Code	3	Used to indicate the purpose of this message 0x00: AMS deregistration request from ABS and network 0x01: request for AMS deregistration from S-ABS and initiation of AMS idle mode. 0x02: response for the unsolicited AAI-DREG-RSP message with action code 0x05 by the ABS. 0x03: reject for the unsolicited AAI-DREG-RSP message with action code 0x05 by the ABS. This code is applicable only when an AMS has a pending UL data to transmit. 0x04: request for AMS deregistration from S-ABS to enter DCR mode 0x05: response for the unsolicited AAI-DREG-RSP message with action code 0x00, 0x01, 0x02, or 0x03 0x06–0x07: <i>Reserved</i>	

Table 6-49—AAI-DREG-REQ message field description (continued)

Field	Size (bits)	Value/Description	Condition
If (Deregistration_Request_ Code == 0x01) {			
<u>Localized-Idle-Mode-flag</u>	<u>1</u>	<u>0: The M2M device enters the normal idle mode.</u> <u>1: The M2M device enters the localized idle mode.</u>	<u>This parameter shall be present when the fixed M2M device enters the idle mode and the localized idle mode is supported by the M2M device</u>
...			
}			
If (Deregistration_Request_ Code == 0x02) {			
<u>Localized-Idle-Mode-flag</u>	<u>1</u>	<u>0: The M2M device enters the normal idle mode.</u> <u>1: The M2M device enters the localized idle mode.</u>	<u>This parameter shall be present when the fixed M2M device enters the idle mode and the localized idle mode is supported by the M2M device</u>
}			
...	...	...	...

6.2.3.22 AAI-DREG-RSP message

Change Table 6-50 as indicated:

Table 6-50—AAI-DREG-RSP message format

Field	Size (bits)	Value/Description	Condition
Action Code	4	Used to indicate the purpose of this message 0x00: AMS shall immediately terminate service with the ABS and should attempt network entry at another ABS 0x01: AMS shall listen to the current ABS but shall not transmit until a RES-CMD message or AAI-DREG-RSP message with action code 0x02 or 0x03 is received. 0x02: AMS shall listen to the current ABS but only transmit on the control connection. 0x03: AMS shall return to normal operation and may transmit on any of its active connections. 0x04: This option is valid in response to an AAI-DREG-REQ message with De-registration_Request_Code = 0x00. The AMS shall terminate current Connected State with the ABS. 0x05: AMS shall begin idle mode initiation: a) to signal AMS to begin idle mode in unsolicited manner or b) to allow AMS to transmit AMS-initiated idle mode request at the REQ-Duration expiration 0x06: This option is valid only in response to an AAI-DREG-REQ message with De-registration_Request_Code 0x01: a) to reject AMS-initiated idle mode request or b) to allow AMS to transmit AMS-initiated idle mode request at the REQ-Duration expiration 0x07: This option is valid in response to an AAI-DREG-REQ message with De-registration_Request_Code = 0x01 to allow AMS-initiated idle mode request. 0x08: This option is valid only in response to an AAI-DREG-REQ message with De-registration_Request_Code 0x04 to allow retention of the AMS's connection information 0x09: This option is valid only in response to an AAI-DREG-REQ message with De-registration_Request_Code 0x04 to reject retention of the AMS's connection information 0x10–0x15: <i>Reserved</i>	
If (Action Code == 0x05) {			

Table 6-50—AAI-DREG-RSP message format (continued)

Field	Size (bits)	Value/Description	Condition
<u>Localized-Idle-Mode-flag</u>	<u>1</u>	<u>0: The M2M device enters the normal idle mode.</u> <u>1: The M2M device enters the localized idle mode.</u>	<u>This parameter shall be present when the fixed M2M device enters the idle mode and when the localized idle mode is supported by the ABS.</u>
Paging cycle	4	Used to indicate Paging cycle for the AMS 0x00: 4 superframes 0x01: 8 superframes 0x02: 16 superframes 0x03: 32 superframes 0x04: 64 superframes 0x05: 128 superframes 0x06: 256 superframes 0x07: 512 superframes <u>0x08: 32 768 superframes</u> <u>0x09: 262 144 superframes</u> <u>0x10: 4 194 304 superframes</u> <u>0x1108–0x15: Reserved</u>	
Paging offset	12	Used to indicate Paging offset for the AMS. Determines the superframe within the paging cycle from which the paging listening interval starts. Shall be smaller than Paging cycle value.	
<u>M2M paging offset</u>	<u>10</u>	<u>Used to indicate the superframe within the paging cycle at which the M2M device's paging listening interval starts. The superframe is determined by concatenating the M2M paging offset field and the Paging offset field. M2M paging offset shall be interpreted as the MSB.</u> <u>Shall be smaller than Paging cycle value.</u>	<u>Shall be present when the Paging cycle value is set to 0x08, 0x09, or 0x10 and the paging offset of an M2M device is set to a value longer than 2048 superframes.</u>
Paging controller ID	48	Used to indicate Paging controller that manages and retains the AMS's idle mode information 0..2 ⁴⁸ –1	<u>For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b0</u>
Paging group ID	16	Used to indicate Paging group that the AMS is located in 0..2 ¹⁶ –1	<u>For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b0</u>
Deregistration ID	18	Used to indicate Deregistration ID used to identify the AMS in idle mode 0..2 ¹⁸ –1	Present when the S-SFH Network Configuration bit == 0b0. <u>For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b0.</u>

Table 6-50—AAI-DREG-RSP message format (continued)

Field	Size (bits)	Value/Description	Condition
<u>Fixed M2M Deregistration ID (FMDID)</u>	<u>16</u>	<u>Fixed M2M Deregistration ID</u>	<u>For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b1.</u>
Idle Mode Retain Information element	5	Provided as part of this message indicative only. Network reentry from idle mode process requirements may change at time of actual reentry. For each bit location, a value of 0 indicates the information for the associated reentry control messages shall not be retained and managed; a value of 1 indicates the information for the associated reentry control message shall be retained and managed. Bit 0: Retain AMS service and operational information associated with AAI-SBC-REQ/RSP messages. Bit 1: Retain AMS service and operational information associated with AAI-PKM-REQ/RSP messages. Bit 2: Retain AMS service and operational information associated with AAI-REG-REQ/RSP messages. Bit 3: Retain AMS service and operational information associated with network address. Bit 4: Retain AMS state information. The information retained by setting bit 4 includes configuration of all Service Flows in the AMS as set by successful AAI-DSA and AAI-DSC transactions. In particular it includes FIDs and related description (QoS descriptors and CS classifier information)	
REQ-Duration	8	Used to indicate waiting value for the AAI-DREG-REQ message with De-registration_Request_Code = 0x01 0..2 ⁸ –1: measured in frames	Present if needed
<u>M2M device-specific Idle Mode Timer</u>	<u>24</u>	<u>Length in seconds of the maximum interval between two consecutive location updates while the M2M device is in idle mode</u>	<u>Shall be present when the M2M device enters idle mode and an ABS assigns a long interval for timer based location update</u>
}			
If (Action Code == 0x06) {			
REQ-Duration	8	Used to indicate waiting value for the AAI-DREG-REQ message with De-registration_Request_Code = 0x01 0..2 ⁸ –1: measured in frames	Present if needed
}			

Table 6-50—AAI-DREG-RSP message format (continued)

Field	Size (bits)	Value/Description	Condition
If (Action Code == 0x07) {			
<u>Localized-Idle-Mode-flag</u>	<u>1</u>	<u>0: The M2M device enters the normal idle mode.</u> <u>1: The M2M device enters the localized idle mode.</u>	<u>This parameter shall be present when the fixed M2M device enters the idle mode and when localized idle mode is supported by the ABS.</u>
Paging cycle	4	Used to indicate Paging cycle for the AMS 0x00: 4 superframes 0x01: 8 superframes 0x02: 16 superframes 0x03: 32 superframes 0x04: 64 superframes 0x05: 128 superframes 0x06: 256 superframes 0x07: 512 superframes <u>0x08: 32 768 superframes</u> <u>0x09: 262 144 superframes</u> <u>0x10: 4 194 304 superframes</u> <u>0x1108–0x15: Reserved</u>	
Paging offset	12	Used to indicate Paging offset for the AMS. Determines the superframe within the paging cycle from which the paging listening interval starts. Shall be smaller than Paging cycle value.	
<u>Second paging offset</u>	<u>12</u>	<u>Used to indicate additional paging offset for the M2M device.</u>	<u>Shall be present when the second paging offset is assigned to the M2M device (see 6.2.18.7.1)</u>
<u>M2M paging offset</u>	<u>10</u>	<u>Used to indicate the superframe within the paging cycle at which the M2M device's paging listening interval starts. The superframe is determined by concatenating the M2M paging offset field and the Paging offset/Second paging offset field. M2M paging offset shall be interpreted as the MSB. Shall be smaller than Paging cycle value.</u>	<u>Shall be present when the Paging cycle value is set to 0x08, 0x09, or 0x10 and the paging offset of an M2M device is set to a value longer than 2048 superframes</u>
Paging controller ID	48	Used to indicate Paging controller that manages and retains the AMS's idle mode information 0..2 ⁴⁸ –1	<u>For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b0</u>
Paging group ID	16	Used to indicate Paging group that the AMS is located in 0..2 ¹⁶ –1	<u>For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b0</u>

Table 6-50—AAI-DREG-RSP message format (continued)

Field	Size (bits)	Value/Description	Condition
Deregistration ID	18	Used to indicate Deregistration ID used to identify the AMS in idle mode 0..2 ¹⁸ –1	Present when the S-SFH Network Configuration bit == 0b0. <u>For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b0.</u>
<u>Fixed M2M Deregistration ID (FMDID)</u>	16	<u>Fixed M2M Deregistration ID</u>	<u>For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b1.</u>
Idle Mode Retain Information element	5	Provided as part of this message indicative only. Network reentry from idle mode process requirements may change at time of actual reentry. For each bit location, a value of 0 indicates the information for the associated reentry control messages shall not be retained and managed; a value of 1 indicates the information for the associated reentry control message shall be retained and managed. Bit 0: Retain AMS service and operational information associated with AAI-SBC-REQ/RSP messages. Bit 1: Retain AMS service and operational information associated with AAI-PKM-REQ/RSP messages. Bit 2: Retain AMS service and operational information associated with AAI-REG-REQ/RSP messages. Bit 3: Retain AMS service and operational information associated with network address. Bit 4: Retain AMS state information. The information retained by setting bit 4 includes configuration of all Service Flows in the AMS as set by successful AAI-DSA and AAI-DSC transactions. In particular it includes FIDs and related description (QoS descriptors and CS classifier information)	
<u>M2M device-specific Idle Mode Timer</u>	24	<u>Length in seconds of the maximum interval between two consecutive location updates while the M2M device is in idle mode</u>	<u>Shall be present when the M2M device enters idle mode and the ABS assigns a long interval for timer based location update</u>
<u>Transmission Type</u>	1	0: <u>Reserved</u> 1: <u>Allowed to send data only after receiving paging message with M2M report code 0b1</u>	<u>Shall be present when the ABS requests an M2M device to send data only after receiving paging message with M2M report code set to 0b01 (see 6.2.18.7.1)</u>