IEEE P802.16p AAI AWD

WirelessMAN-Advanced Air Interface for Broadband Wireless Access Systems

Enhancements to Support Machine-to-Machine Applications

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Introduction

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This amendment specifies support for Machine-to-Machine Applications. As of the publication date, the current applicable version of IEEE Std 802.16 is IEEE Std 802.16-2009, as amended by IEEE 802.16j-2009, IEEE 802.16h-2010, and IEEE 802.16m-2011.

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This document was developend by the IEEE 802.16 Working Group on Broadband Wireless Access, which develops the WirelessMAN® Standard for Wireless Metropolitan Area Networks.

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NOTE-The editing instructions contained in this amendment define how to merge the material contained herein into the existing base standard IEEE Std 802.16-2009 as amended by IEEE Std 802.16j, IEEE Std 802.16h, and IEEE 802.16m. The editing instructions are shown in ***bold italic***. Four editing instructions are used: ***change***, ***delete***, ***insert***, and ***replace***. ***Change*** is used to make small corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using strike through (to remove old material) and underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is used to make large changes in existing text, subclauses, tables, or figures by removing existing material and replacing it with new material. Editorial notes will not be carried over into future editions because the changes will be incorporated into the base standard.

1. Overview

1.1 Scope

1.2 Purpose

1.4 Reference models

3. Definitions

Add the following definitions:

3.147 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.

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

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

3.150 M2M Server: An entity that communicates with M2M devices. The M2M server runs M2M applications and provides M2M specific services for one or more M2M devices.

3.151 M2M feature: A unique characteristic of an M2M application that is supported by the M2M ASN. One or more features may be needed to support an application.

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

6. WirelessMAN-Advanced Air Interface

6.1 Introduction

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 texts 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 ABS in 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

6.2.1.3.1 M2M Group Identifier (MGID)

A 15-bit value that uniquely identifies an M2M group in the domain of the network entity that assigns MGID that one or more M2M devices belong to.

An MGID is assigned to a service flow of an M2M device by a network entity after initial network entry through DSA procedure and released during an explicit network exit (e.g., power down location update) or when the M2M device enters DCR mode. The assigned MGID shall be retained by an M2M device even in idle state unless the M2M device exits from the network or the network explicitly deletes the service flow associated with the MGID. The MGID can be re-assigned during connected state and idle state. During connected state, the MGID may be changed, and deleted by DSC, and DSD procedure respectively.

During the idle state, the MGID may be changed by location update (i.e., M2M device-initiated location update or ABS-initiated location update) or network reentry. When the ABS updates the MGID through the ABS-initiated location update, the ABS can trigger the group location update as well as individual location update. When the ABS changes the MGID of all M2M devices within the multicast group, the ABS can trigger the group location update via paging message. When the M2M device performs the timer based 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.

6.2.1.3.2 Fixed M2M Deregistration ID (FMDID)

A 16-bit value that uniquely identifies a fixed M2M device in the base station that assigns FMDID. An FMDID is assigned to a fixed M2M device by a base station during idle mode entry and released during an explicit network exit (e.g., power down location update) or when the M2M device performs the network reentry.

6.2.2 MAC PDU formats

6.2.2.1.3 MAC signaling header

Change the contents of Table 662 as indicated

Table 662—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	M2M Bandwidth request (BR) with STID header
~~01000~~01001-11111	*Reserved*

Add new subclause 6.2.2.1.3.9

6.2.2.1.3.9 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. M2M BR with STID header format is defined in Table 670a.

Table 670a—M2M BR with STID header format

Syntax	Size (bit)	Notes
M2M BR with STID () {		
FID	4	Flow Identifier. Set to 0010.
Type	5	MAC signaling header type = 0b01000.

Table 670a—M2M BR with STID header format

Syntax	Size (bit)	Notes
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
}		

6.2.3 MAC Control messages

6.2.3.1 AAI-RNG-REQ

Modify Table 684 as indicated

Table 684—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 = Abnormal power down indication ~~0b1110 –~~0b1111 = *Reserved*	
...	...		...
} 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.	If the Localized_Idle_Mode_Accepted flag is set to 1 in AAI-DREG-REQ/RSP message, DID shall not be included in this message.

Table 684—AAI-RNG-REQ message field description

Field	Size (bits)	Value	Condition
Fixed M2M Deregistration ID (FMDID)	16	Used to indicate Fixed M2M Deregistration ID used to identify the fixed M2M device in idle mode 0..2^{16}-1	Only present if the Localized_Idle_Mode_Accepted flag is set to 1 in AAI-DREG-REQ/RSP message.
}			
MFM bitmap	2	Maximum of 2 distinct concurrent MFM are allowed with MFM_bitmap. LSB #0: MFM 0 LSB #1: MFM 4	Present if MFM 0 or MFM 4 are supported by a fixed M2M device
If (LSB#0 in MFM_bitmap == 1){			
Wideband CQI	4		
Wideband STC rate	3	.'STC rate - 1.' mapped to 3-bit unsigned integer (i.e., STC rate=1 as 0b000 ~ STC rate=8 as 0b111)	
}			
If (LSB#1 in MFM_bitmap == 1){			
Wideband CQI	4		
Wideband STC	3	'STC rate - 1.' mapped to 3-bit unsigned integer (i.e., STC rate=1 as 0b000 ~ STC rate=8 as 0b111)	
Wideband PMI	6	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) set to zero(0)	
}			
Paging Controller ID	48	The Paging Controller ID that the AMS currently maintains in idle mode.	If the Localized_Idle_Mode_Accepted flag is set to 1 in AAI-DREG-REQ/RSP message, Paging Controller ID shall not be included in this message.
...			
Bandwidth Request Indicator	1	1: indicates BW grant is required for transmission of BR header after completion of network reentry	Optional
} else if (Ranging Purpose Indication == 0b0011 |0b0110|0b0111| 0b1011) {		// Idle mode location update (and with other additional purposes)	

Table 684—AAI-RNG-REQ message field description

Field	Size (bits)	Value	Condition
...	...	...	...
~~}//end of Ranging Purpose Indication~~ else if (Ranging Purpose Indication == 0b1110) {		//Abnormal or involuntary power down	
}			
...	...	...	...
Retrials	2	The number of failed trials in this ranging process Bits 0-1: Indicates the number of retrials in the channel ranging access as follows: 00 - Success in the first attempt 01 - Success in the second attempt 10 - Success in the third attempt 11 - Success in the 4th or later attempt	May be included by M2M devices after initial ranging during network entry or re-entry, periodic ranging, or HO ranging.

6.2.3.2 AAI-RNG-RSP

Modify Table 685 as indicated

Table 685—AAI-RNG-RSP message field description

Field	Size (bits)	Value/Description	Condition
...		...	...
Unsolicited bandwidth grant indicator	1	1: In case of initial network entry, it indicates an unsolicited BW grant will be available for transmission of BR header without request from AMS during network entry. In case of network reentry, it indicates an unsolicited BW grant will be available for transmission of BR header without request from M2M device during network reentry from idle mode	Shall be included when AMS is attempting network entry Shall be included if AAI-RNG-RSP message is transmitted in response to AAI-RNG-REQ message that includes bandwidth request indicator during network reentry from idle mode.
For(*i*=0;*i*<Num_MGID; *i*++){		Number of MGID and FID (Num_MGID) to update in the T-ABS[1..TBD]. Mapping of current MGID and FID and new MGID and FID to be updated.	Presented if it needs to be updated
Current MGID	15		
Current FID	4		
New MGID	15		

Table 685—AAI-RNG-RSP message field description

Field	Size (bits)	Value/Description	Condition
New FID	4		
}			
...		...	...
If (Location Update Response== 0x0){			
...	...	...	...
New Fixed M2M Deregistration ID	16	New FMDID that the fixed M2M device shall maintain in idle mode.	Only present if the Localized_Idle_Mode_Accepted flag is set to 1 in AAI-DREG-REQ/RSP message.
...	...	...	...
}			
...	...	...	...

6.2.3.9 AAI-REG-RSP

Change the contents of Table 692 as indicated

Table 692—AAI-REG-RSP message field description

Field	Size (bits)	Value/Description	Condition
...	...	...	...
STID_Valid_Periodicity	3	The STID_Valid_Periodicity together with STID_Valid_Offset indicates at which frames the assigned STID is valid for the M2M device	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
STID_Valid_Offset	3	The STID_Valid_Offset together with STID_Valid_Periodicity indicates at which frames the assigned STID is valid for the M2M device	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

6.2.3.21 AAI-DREG-REQ message

Modify Table 704 as indicated

Table 704—AAI-DREG-REQ message field description

Field	Size (bits)	Value/Description	Condition
Localized_Idle_Mode_Accepted flag	1	0: The M2M device enters the normal idle mode. 1: The M2M device enters the localized idle mode.	This parameter shall be presented when the fixed M2M device enters the idle mode.
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 code0x05 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: *Reserved*	
...	...	...	...

6.2.3.22 AAI-DREG-RSP message

Modify Table 705 as indicated

Table 705—AAI-DREG-RSP message format

Field	Size (bits)	Value/Description	Condition
Localized_Idle_Mode_Accepted flag	1	0: The M2M device enters the normal idle mode. 1: The M2M device enters the localized idle mode.	This parameter shall be presented when the fixed M2M device enters the idle mode.

Table 705—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 a 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 a 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 a 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: *Reserved*	
If (Action Code == 0x05) {			

Table 705—AAI-DREG-RSP message format

Field	Size (bits)	Value/Description	Condition
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 0x08: 32768 superframes 0x09: 262144 superframes 0x10: 4194304 superframes 0x11~~08~~-0x15: *Reserved*	Values 0x08-0x10 may be applied to M2M devices only.
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.	
M2M paging offset	10	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. Shall be smaller than Paging cycle value.	May be present when the Paging cycle value is set to 0x08, 0x09, or 0x10
Paging controller ID	48	Used to indicate Paging controller that manages and retains the AMS's idle mode information $0..2^{48}-1$	
Paging group ID	16	Used to indicate Paging group that the AMS is located in $0..2^{16}-1$	
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

Table 705—AAI-DREG-RSP message format

Field	Size (bits)	Value/Description	Condition
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
M2M device-specific Idle Mode Timer	24	Length in seconds of the maximum interval between two consecutive location updates while the M2M device is in idle mode	May present when the M2M device enters idle mode
}			
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
}			
If (Action Code == 0x07) {			

Table 705—AAI-DREG-RSP message format

Field	Size (bits)	Value/Description	Condition
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 0x08: 32768 superframes 0x09: 262144 superframes 0x10: 4194304 superframes 0x11~~08~~-0x15: *Reserved*	Values 0x08-0x10 may be applied to M2M devices only.
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.	
Second paging offset	12	Used to indicate additional paging offset for the M2M device.	Optional
M2M paging offset	10	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. Shall be smaller than Paging cycle value.	May be present when the Paging cycle value is set to 0x08, 0x09, or 0x10
Paging controller ID	48	Used to indicate Paging controller that manages and retains the AMS's idle mode information $0..2^{48}-1$	
Paging group ID	16	Used to indicate Paging group that the AMS is located in $0..2^{16}-1$	
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

Table 705—AAI-DREG-RSP message format

Field	Size (bits)	Value/Description	Condition
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)	
M2M device-specific Idle Mode Timer	24	Length in seconds of the maximum interval between two consecutive location updates while the M2M device is in idle mode	May present when the M2M device enters idle mode
Transmission Type	1	0 : *Reserved* 1 : Allowed to send data only after receiving paging message with M2M report code 0b1	Present if needed
Max number of paging cycle	16	This is for M2M device to wait for AAI-PAG-ADV with M2M report code 0b1. See 6.2.18.7.1. The unit is the duration of the paging cycle.	Present if Transmission Type is set to 1
}			

6.2.3.23 AAI-PAG-ADV (paging advertisement) message

Modify Table 706 as indicated

Table 706—AAI-PAG-ADV message field description

Field	Size (bits)	Value/Description	Condition
...	...	...	...
For (*i*=0; *i*<M; *i*++) {			M equals the number of bits in Paging_Group_IDs bitmap whose bit is set to 1.
For (*j*=0; *j*<Num_AMSs; *j*++) {		Num_AMSs indicates the number of paged AMSs in a corresponding paging group 1..32	
Deregistration Identifier	18	Used to indicate Deregistration ID for the AMS to be paged (Deregistration Identifier and Paging Cycle are used to identify each paged AMS) 0..2^{18}- 1	Present if the S-SFH Network Configuration bit == 0b0
MAC Address Hash	24	Used to identify the AMS to be paged	Present if the S-SFH Network Configuration bit == 0b1
Paging Cycle	4	Used to indicate Paging cycle for the AMS to be paged 0x00: 4 superframes 0x01: 8 superframes 0x02: 16 superframes 0x03: 32 superframes 0x04: 64 superframes 0x05: 128 superframes 0x06: 256 superframes 0x07: 512 superframes 0x08: 32768 superframes 0x09: 262144 superframes 0x10: 4194304 superframes 0x11~~08~~-0x15: *Reserved*	Present if the S-SFH Network Configuration bit == 0b0 Values 0x08-0x10 shall be applied to M2M devices only.
Action Code	1	Used to indicate the purpose of the AAI-PAG-ADV message 0b0: perform network reentry 0b1: perform ranging for location update	
M2M Report code	1	Indication for the M2M device to send the uplink report 0b0 : *reserved* 0b1 : Send uplink report	Present if M2M is supported
}			

Table 706—AAI-PAG-ADV message field description

Field	Size (bits)	Value/Description	Condition
For (*i*=0; *i*<Num_MGID; *i*++) {		Num_MGID indicates the number of MGIDs included in this paging message [0..63]	Shall be included if the ABS sends DL multicast data for M2M after transmission of the AAI-PAG-ADV message.
MGID	15	M2M Group ID	
Action Code	2	0b00: Performing network reentry 0b01: Performing location update 0b10: Receiving multicast traffic 0b11: *Reserved*	
If (Action Code == 0b00) {			
M2M network re-entry type	3	Indicate the network re-entry scheme for M2M device 0b000: dedicated channel allocation for AAI-RNG-REQ 0b001: dedicated ranging channel allocation, S-RCH 0b010: dedicated ranging channel allocation, NS-RCH 0b011-0b111: *Reserved*	
Dedicated channel allocation	TBD	If M2M network re-entry type = 0, to indicate Resource Index for AAI-RNG-REQ; If M2M network re-entry type = 1, 2 to indicate dedicated ranging channel allocation;	
Dedicated channel allocation timer	TBD		
}			
If (Action Code == 0b10) {			
Multicast transmission start time (MTST)	8	Least significant 8 bits of the frame number in which the ABS starts sending DL multicast data.	Shall be present when the MTST needs to be included in this message.
}			
}			
For (*j*=0; *j*<Num_FMDID; *j*++) {		Num_FMDID indicates the number of FMDIDs included in this paging message [1..32]	Shall be included when the ABS pages the fixed M2M devices.

Table 706—AAI-PAG-ADV message field description

Field	Size (bits)	Value/Description	Condition
Fixed M2M Deregistration ID (FMDID)	16	Fixed M2M Deregistration ID	
Action Code	1	0: Performing network re entry 1: Performing location update	
M2M report code	1	Indicate the opportunity for the M2M device to send the uplink report 1: Send uplink report	Present if M2M is supported
}			
}			
...	...	...	...

6.2.3.31 AAI-System Configuration Descriptor (SCD) message

Change the contents of Table 714 as indicated

Table 714—AAI-SCD message field description

Field	Size (bits)	Value/Description	Condition
MSB of the extended superframe number for M2M	10	The 10 MSB of the extended superframe number, which is a 22-bit number obtained by concatenating this value with the superframe number as signaled by the P-SFH and S-SFH SP1.	
Access class restriction of frame (i)	1	INTEGER (0..1)	Optional
Access class restriction of frame (i+1)	1	INTEGER (0..1)	Optional
Access class restriction of frame (i+2)	1	INTEGER (0..1)	Optional
Access class restriction of frame (i+3)	1	INTEGER (0..1)	Optional
FixedM2M_periodOfPeriodicRngTimer	3	It is the period of periodic ranging timer that is broadcasted by the ABS. [The value is TBD]	For fixed M2M devices

Table 714—AAI-SCD message field description

Field	Size (bits)	Value/Description	Condition
M2M Configuration Change Count	4	The value is increased whenever the contents of the dedicated raging information for M2M devices are changed. The value rolls over from 0 to 15. The operation of this field is same with Configuration Change Count as defined in 6.2.3.31.	
M2M ranging indicator	2	Indicate the ranging configuration for M2M devices. 0b00: normal ranging as defined in Table 839 in 6.3.5.5.1.2 0b01: dedicated ranging for M2M devices 0b10: allow both normal and dedicated ranging 0b11: no ranging (not allow network re-/entry)	
If ((M2M ranging indicator == 0b01) or (M2M ranging indicator == 0b10) {			
M2M ranging opportunity subframe index	3	Indicates the subframe index of the allocated ranging opportunity dedicated for M2M devices.	
Periodicy of the M2M ranging	[3]	Indicates the periodicy of the ranging dedicated for M2M devices. 0b000: transmission in every frame 0b001: transmission in the first frame in every superframe 0b010: transmission in the first frame in every even numbered superframe, i.e., mod(superframe number, 2) = 0 0b011: transmission in the first frame in every 4th superframe, i.e., mod(superframe number, 4) = 0 [0b100~0b111: *Reserved*]	
}			

6.2.3.43 Privacy key MAC Control messages (AAI-PKM-REQ/AAI-PKM-RSP)

Change Table 726 as indicated

Table 726—AAI-PKM-REQ message field description

Field	Size (bits)	Value/Description	Condition
PKM v3 message type code	4	- PKMv3 Reauth-Request; PKM v3 message code = 1 - PKMv3 EAP-Transfer; PKM v3 message code = 2 -PKMv3 Key_Agreement-MSG#2; PKM v3 message code = 4 - PKMv3 TEK-Request; PKM v3 message code = 6 - PKMv3 TEK-Invalid; PKM v3 message code =8 - PKMv3 MGTEK-Request; PKM v3 message code = 10 ~~9~~12-16: *Reserved*	
...	...	...	...
If (PKM v3 message code == 10) {			
MGID	15	Multicast group identifier that the AMS subscribes.	May be present when an M2M device is registered for M2M multicast service of the M2M group
~~}~~			

Change Table 727 as indicated

Table 727—AAI-PKM-RSP message field description

Field	Size (bits)	Value/Description	Condition
PKM v3 message type code	4	- PKMv3 EAP-Transfer; PKM v3 message code =2 - PKMv3 Key_Agreement-MSG#1; PKM v3 message code =3 - PKMv3 Key_Agreement-MSG#3; PKM v3 message code =5 - PKMv3 TEK-Reply; PKM v3 message code =7 - PKMv3 TEK-Invalid; PKM v3 message code =8 - PKMv3 MGTEK-Update; PKM v3 message code = 9 - PKMv3 MGTEK-Reply; PKM v3 message code = 11 ~~9~~12-16: *Reserved*	
...			

Table 727—AAI-PKM-RSP message field description

Field	Size (bits)	Value/Description	Condition
If (PKM v3 message code == 9) {			
New_MGSS	64	A newly provided MGSS (M2M service Group Security Seed) for an M2M group	May be present when an M2M device is registered for M2M multicast service of the M2M group
}			
If (PKM v3 message code == 11) {			
MGID	15	Multicast group identifier	May be present when an M2M device is registered for M2M multicast service of the M2M group
MGSS	64	MGSS of the currently used MGTEK	May be present when an M2M device is registered for M2M multicast service of the M2M group
M2MGTEK_COUNT		The index of the currently used MGTEK	May be present when an M2M device is registered for M2M multicast service of the M2M group
}			

Change Table 728 as indicated

Table 728—PKM v3 message types

Code	PKM message type	MAC control message name
1	PKMv3 Reauth-Request	AAI-PKM-REQ
2	PKMv3 EAP-Transfer	AAI-PKM-REQ/AAI-PKM-RSP
3	PKMv3 Key_Agreement-MSG#1	AAI-PKM-RSP
4	PKMv3 Key_Agreement-MSG#2	AAI-PKM-REQ
5	PKMv3 Key_Agreement-MSG#3	AAI-PKM-RSP
6	PKMv3 TEK-Request	AAI-PKM-REQ
7	PKMv3 TEK-Reply	AAI-PKM-RSP

Table 728—PKM v3 message types

Code	PKM message type	MAC control message name
8	PKMv3 TEK-Invalid	AAI-PKM-REQ/AAI-PKM-RSP
9	PKMv3 MGTEK-Update	AAI-PKM-RSP
10	PKMv3 MGTEK-Request	AAI-PKM-REQ
11	PKMv3 MGTEK-Reply	AAI-PKM-RSP
~~9~~12-16	*Reserved*	-

6.2.3.47 DSx MAC Control message

6.2.3.47.1 AAI-DSA-REQ

Change the paragraph as indicated

The following parameters may be included in the AAI-DSA-REQ message:

— Predefined BR index parameters: Predefined BR index parameters define the mapping from pre-defined BR index(es) to BR action and BR size, which is used in 3-step Bandwidth Request procedure, and are only included in ABS-initiated DSA-REQ. They are determined based on the QoS parameters of the service flow in the AAI-DSx messages. If BR Action is 0b00 or 0b01, the same BR Index shall not be assigned to different service flows. If BR action is 0b10 (BR), ABS shall assign different BR index to service flows whose UL Grant Scheduling Type is different and shall assign different BR index to different service flows whose UL Scheduling Type is same but BR size is different. If the STID assigned to an M2M device is shared with other M2M device(s), then ABS shall assign different BR indexes to the M2M devices sharing STID. The ABS shall use the STID and assigned BR index received in the quick access message to identify the M2M device if the received STID is assigned to multiple M2M devices.

Change Table 740 as indicated

Table 740—AAI-DSA-REQ message field description

Field	Size (bits)	Value/Description	Condition
...	...	...	...
MGID	15	MGID to be added	Shall be present if this service flow is related with M2M multicast service and when an 802.16p BS initiates AAI-DSA-REQ.
MGSS	64	MGSS (M2M service Group Security Seed) for an M2M group	May be present when an ABS initiates AAI-DSA-REQ for this service flow that is related with M2M multicast service

6.2.3.47.2 AAI-DSA-RSP

Change Table 741 as indicated

Table 741—AAI-DSA-RSP message field description

Field	Size (bits)	Value/Description	Condition
...	...	...	...
Confirmation Code	1	Zero indicates the request was successful. Nonzero indicates failure	Shall always be present
If (Confirmation Code == 0 && AMS-initiated AAI-DSA-REQ)			
{			
FID	4	An identifier of a service flow	
MGID	15	MGID to be added	Shall be present if this service flow is related with M2M multicast service and when an M2M device initiates AAI-DSA-REQ.
}			
...	...	...	...

6.2.3.47.4 AAI-DSC-REQ

Add new parameter at the end of Table 743 as indicated

Table 743—AAI-DSC-REQ message field description

Field	Size (bits)	Value/Description	Condition
...	...	...	...
MGID	15	MGID to be changed to	Shall be present if MGID needs to be changed

Add new subclause 6.2.3.64

6.2.3.64 AAI-MTE-IND (Multicast transmission end indication) message

The ABS shall send AAI-MTE-IND message to M2M devices to indicate the end of multicast transmission. If an M2M device in idle mode receives the AAI-MTE-IND message, the M2M device may enter the paging unavailable interval as specified in 6.2.18.2.

Table 763a—AAI-MTE-IND message field description

Field	Size (bits)	Value/Description	Condition
FID	4	Flow ID related to the multicast traffic	

6.2.4 Construction and transmission of MAC PDUs

6.2.5 AAI Security

Add new subclause 6.2.5.5 as indicated

6.2.5.5 Security Support for Multicast Traffic

Security for multicast traffic provides encryption and integrity protection of such data information for secure group informing and management. A common M2M service group traffic encryption key (MGTEK) is used by M2M devices within a group.

6.2.5.5.1 Key Derivation

The key hierarchy defines what keys are present in the system for multicast traffic and how keys are generated. The ABS derives the M2M service Group Security Seed (MGSS) from the network entity that manages M2M group.

6.2.5.5.1.1 MGTEK Derivation

The MGTEK is the transport encryption key used to encrypt M2M service multicast data. The MGTEK is derived based on the MGSS, M2MGTEK_COUNT and the MAK (M2M service Authorization Key). The generation and transport of the MAK is outside the scope of the IEEE 802.16 standard.

The MGSS is provided through the AAI-DSA transaction during the network entry, which also provides MGID.

The MGTEK derivation is done:

$$MGTEK = Dot16KDF(MAK, MGSS \mid M2MGTEK\_COUNT \mid MGID \mid \text{“MGTEK”}, 128), \quad (1)$$

Where:

- MAK is M2M service Authorization Key that is provided to all authorized M2M devices.
- MGSS is M2M service Group Security Seed that is common for a M2M group.
- M2MGTEK_COUNT is the index of the currently used MGTEK.
- MGID is the identifier of the group, which the AMS and MAK and MGSS is associated with.

6.2.5.5.2 Key Hierarchy

Figure 456a outlines the process to calculate the MGTEK based on a MAK, a M2MGTEK_COUNT and a MGSS provided by the ABS.

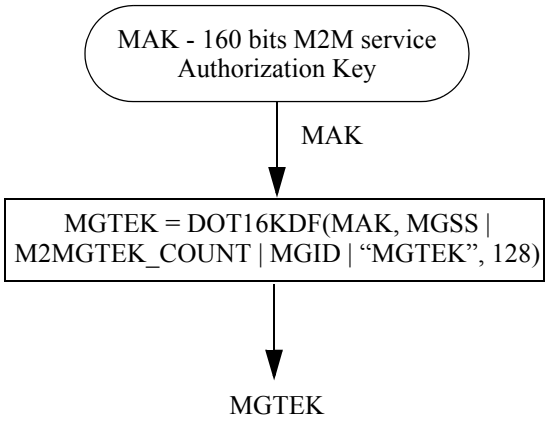

Figure 456a—MGTEK derivation from MAK

6.2.5.5.3 MGTEK Key Usage

The MGTEK is used for encrypting DL multicast data by the ABS, which is also used for decrypting such DL multicast data by the AMS.

6.2.5.5.3.1 MGTEK Update

The MGTEK update is triggered whenever a new MAK is derived, or the 3 MSB of ROC concatenated with the frame number reaches 0x7FFFFF or a member of the M2M group has been unsubscribed.

When the 3 MSB of ROC concatenated with the frame number reaches 0x7FFFFF, the M2MGTEK_COUNT is incremented by one, and a new MGTEK is derived.

When the MGTEK update is triggered due to an unsubscribing member, a new MGSS is provided to AMSs in the M2M group through AAI-PKM-RSP message. The M2MGTEK_COUNT is initialized. A new MGTEK is generated with the new MGSS and the M2MGTEK_COUNT.

The AMS may request current M2MGTEK parameters by transmitting an AAI-PKM-REQ message to the ABS. Here, the AMS shall include its MGID. After authenticating the AAI-PKM-REQ, the ABS shall respond with current MGSS and M2MGTEK_COUNT via the AAI-PKM-RSP message.

6.2.5.5.3.2 Key Update during Location Update

When a new MGSS is derived, an AMS in idle mode shall be indicated through an AAI-PAG-ADV message to perform network reentry to update the MGTEK. When an ABS detects that the AMS is to update the MGTEK, the ABS sends the new MGSS in the AAI-PKM-RSP message.

6.2.5.5.4 Encrypted M2M multicast MPDU format

Unique initial counter and MGTEK pair is required across all messages. This subclause describes the initialization of the 128-bit initial counter, constructed from the frame number and a new 8-bit Rollover counter (ROC).

ROC shall be reset to zero upon obtaining a new MGTEK. The first 3 most significant bits of the ROC is the rollover counter for the frame number, i.e., when the frame number reaches 0x0000 (from 0x3FFF) it is incremented by 1 mod 8. The 5 least significant bits of ROC shall be allocated to M2M multicast MAC PDUs in such manner that no two M2M multicast MAC PDUs in the same frame using the same MGTEK have the same ROC value.

Using this method, up to 32 PDUs per frame using the same MGTEK can be supported. A new encryption key (MGTEK) is required every $2^3 \times 2^{14} = 2^{17}$ frames .

The PDU payload for AES-CTR encryption shall be prepended with the 8-bit ROC, i.e., the ROC is the 8 MSBs of the 32-bit nonce. The ROC shall not be encrypted.

Any tuple value of {AES Counter, KEY} shall not be used more than once for the purposes of encrypting a block. The AMS and ABS shall ensure that a M2MGTEK_COUNT is incremented by one, and a new MGTEK is derived and ready for use before the 3 MSB of ROC concatenated with the frame number reaches 0x7FFFFF.

A 32-bit nonce is constructed as Table 774a.

Table 774a—Construction of 32-bit nonce

Byte number	0	1 2	3
Field	ROC	Superframe number	Frame index
Contents	ROC	0b0000 | MSB 4-bit of superframe number| LSB 8-bit of superframe number	0b000000 | Frame index (2 bits)

A 32-bit nonce NONCE = n0 | n1 | n2 | n3 is made of ROC and 12 bits superframe number and 2 bits frame index (see Table 774a). NONCE shall be repeated four times to construct the 128-bit counter block required by the AES-128 cipher. (initial counter = NONCE|NONCE|NONCE|NONCE). When incremented, this 16-byte counter shall be treated as a big endian number.

This mechanism can reduce per-PDU overhead of transmitting the full counter. At the most 2^{32} PDUs can be encrypted with a single MGTEK.

The plaintext PDU shall be encrypted using the active MGTEK derived from MAK, MGSS and M2MGTEK_COUNT, according to CTR mode specification. A different 128-bit counter value is used to encrypt each 128-bit block within a PDU.

The processing yields a payload that is 8 bits longer than the plaintext payload. See Figure 456b—.

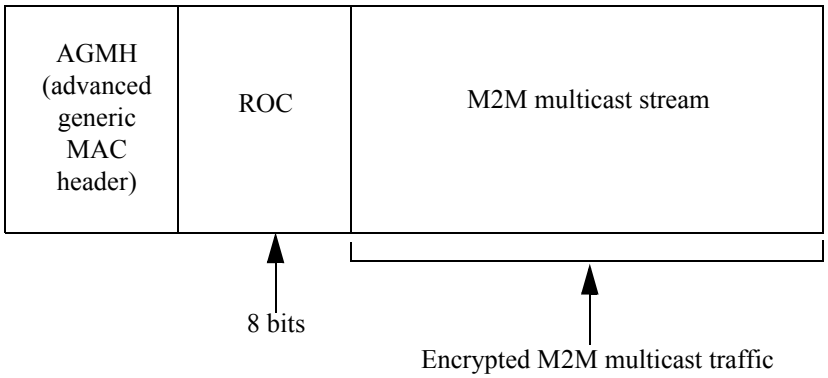

Figure 456b—M2M multicast MAC PDU ciphertext payload format

6.2.6 MAC HO procedures

6.2.7 Persistent scheduling in the Advanced Air Interface

6.2.8 Multicarrier operation

6.2.9 Group Resource Allocation

6.2.10 Connection management

6.2.11 Bandwidth request and allocation mechanism

6.2.12 Quality of service (QoS)

6.2.13 ARQ mechanism

6.2.14 HARQ functions

6.2.14.2.1.2 Uplink

Add the following texts at the end of 6.2.14.2.1.2

When an ABS allocates new UL resource to an M2M device sharing a STID, if there is UL burst retransmitted by another device sharing the same STID at the same UL subframe, the ABS shall allocate the new UL resource by using different ACID from the ACID of retransmitted UL burst.

6.2.15 Network entry and initialization

Add new subclause 6.2.15.7 as indicated

6.2.15.7 Access class of M2M devices

The ABS may restrict ranging of M2M devices by setting the access class to 1 in the AAI-SCD message. Access class set to 1 restricts M2M devices from performing ranging for network reentry. The M2M devices may perform network entry/reentry after the ABS sets the M2M access class to 0.

Access class restriction in AAI-SCD message may be used for configuring each of the 4 frames in a super-frame individually. The ABS can decide the frame(s) in a superframe that the M2M devices can use for ranging during network re-entry.

Table 795a—Mapping for access class

Access class restriction	Notes
0	M2M devices may access the network
1	M2M devices shall not access the network

6.2.16 Periodic ranging

6.2.17 Sleep mode

6.2.18 Idle mode

Add new subclause 6.2.18.7 as indicated

6.2.18.7 Idle mode for M2M application

The procedures described in this subsection shall apply to M2M devices. In case there is a contradiction between this subsection and other subsections of 6.2.18, the procedures described in this subclause shall take precedence.

M2M device-specific Idle Mode Timer for the M2M device may be assigned during idle mode initiation. In this case, the AAI-DREG-RSP message includes M2M device-specific Idle Mode Timer. When the M2M device receives the AAI-DREG-RSP message with M2M device-specific Idle Mode Timer, the M2M device shall perform location update prior to the expiration of the M2M device-specific Idle Mode Timer. At every location update including the paging group location update, the M2M device-specific Idle Mode Timer is restarted.

6.2.18.7.1 Paging operation

Group paging may be used for M2M devices. For this, M2M Group Identifier (MGID) defined in 6.2.1.3.1 may be included in a paging message instead of an individual identifier to identify the group of M2M devices.

AAI-PAG-ADV with M2M report code set to 0b1 may be used to poll M2M devices for periodic uplink non-realtime data transmission for fixed M2M devices. The interval of periodic uplink data transmission should be longer than or equal to the paging cycle. When an M2M device receives the AAI-DREG-RSP message with the Transmission Type set to 1 and Max number of paging cycle attribute, the M2M device may wait for the AAI-PAG-ADV with M2M report code = 1 at Max number of paging cycle × paging cycle . If the M2M device does not receive the AAI-PAG-ADV with M2M report code = 1, it should not send the uplink.

Two paging offsets may be assigned to the M2M device with a long paging cycle (e.g., above several minutes or hours) at the idle mode initiation. If the M2M device does not receive the AAI-PAG-ADV message at its first paging offset, the M2M device shall monitor the transmission of the AAI-PAG-ADV message at its second paging offsets. After transmitting the AAI-PAG-ADV message with action code 0b0 (Performing network reentry) during M2M device's first paging offset, if the ABS does not receive a response from the

paged M2M device, the ABS may re-page this M2M device at its second paging offset that is indicated in AAI-DREG-RSP message.

6.2.18.7.2 Network re-entry from idle mode for M2M devices

BS may assign ranging resources, including ranging code and ranging opportunity, dedicated for M2M devices. In this case, M2M devices perform ranging for network (re-)entry using dedicated ranging resources. When BS assigns the CDMA Allocation A-MAP IEs for AAI-RNG-REQ to those M2M devices, the opportunity index in RA-ID masked for the CDMA Allocation A-MAP IEs can be set to one of opportunity index '0b01' and '0b10'. In this case, the opportunity index for assignment of the dynamic NS-RCH shall be set to the other value. The information of dedicated ranging resources is transmitted in the AAI-SCD message. If BS does not assign dedicated ranging resources, M2M devices perform ranging for network (re-)entry using the ranging resources defined in Table 833 in 6.3.5.5.1.2. The configuration of ranging assignment for M2M devices is indicated through M2M ranging indicator in the AAI-SCD message.

Based on the mobility and traffic characteristics of the M2M device, the ABS can select the proper network re-entry type for M2M device based on the Table 795b, and the ABS shall inform the M2M device the network re-entry type in AAI-PAG-ADV message.

Table 795b—Scheme selection of network re-entry for M2M

Network re-entry type	Network re-entry scheme	Note
0	Dedicated channel allocation for AAI-RNG-REQ, A-MAP IE offset for AAI-RNG-REQ is indicated in AAI-PAG-ADV	Fixed M2M, known traffic pattern, UL synchronization not required
1	Dedicated ranging channel allocation for M2M group, S-RCH used for ranging	Fixed M2M, UL Synchronization required
2	Dedicated ranging channel allocation for M2M group, NS-RCH used for ranging	Mobile M2M, known traffic pattern

If the network re-entry type is set to ‘0’, the M2M device doesn't need to send CDMA code for ranging but sends AAI-RNG-REQ message with the channel allocation in ‘Dedicated channel allocation’ in AAI-PAG-ADV message.

If the network re-entry type is set to ‘1’, the ABS shall allocate the dedicated ranging channel for M2M device in AAI-PAG-ADV message, the dedicated S-RCH allocation is used for ranging.

If the network re-entry type is set to ‘2’, the ABS shall allocate the dedicated ranging channel for M2M device in AAI-PAG-ADV message, the dedicated NS-RCH allocation is used for ranging.

An M2M device may perform ranging process using the initial ranging backoff window assigned by TBD message. The duration of this initial backoff window may be different from one assigned by SFH SP3.

During network reentry, the M2M device may request UL BW grant without a contention-based bandwidth request by including Bandwidth Request Indicator in an AAI-RNG-REQ message. If an ABS receives the AAI-RNG-REQ message with Bandwidth Request Indicator set to 1, the ABS may allocate an UL bandwidth for transmission of BR without STID header, without a contention-based bandwidth request from the M2M device by setting the Unsolicited bandwidth grant indicator in an AAI-RNG-RSP message to the M2M device. If the Unsolicited bandwidth indicator is enabled, the ABS should allocate UL bandwidth within the BR grant time duration for transmission of the BR without STID header after sending the AAI-RNG-RSP message.

The M2M device should monitor the A-MAP IE during the BR grant time duration for possible bandwidth allocation without performing any bandwidth request. If the M2M device fails to identify allocated bandwidth within the BR grant time duration, the M2M device may perform contention based bandwidth request.

The BR grant timer in ABS is started when the ABS transmits the AAI-RNG-RSP message with the unsolicited bandwidth grant indicator set to 1 to the M2M device.

The BR grant timer in M2M device is started when the M2M device receives the AAI-RNG-RSP message with the unsolicited bandwidth grant indicator set to 1 sent to it.

6.2.18.7.3 Idle mode optimizations for fixed M2M devices

Localized idle mode operation for idle mode M2M devices: A fixed M2M device in idle mode need not perform the paging group based update. To eliminate the need for paging group based update and allocating the unnecessary paging information (i.e., Paging Group ID, Paging Controller ID), a fixed M2M device may include Localized_Idle_Mode_Accepted flag set to 1 in the AAI-DREG-REQ message.

When a BS receives a AAI-DREG-REQ with Localized_Idle_Mode_Accepted flag set to 1, it does not inform the Paging Controller that the M2M device enters idle mode.

Then the BS sends AAI-DREG-RSP with Localized_Idle_Mode_Accepted flag set to 1 or 0. Localized_Idle_Mode_Accepted flag set to 1 indicates that BS accepted M2M device's request. Then the M2M device transitions to idle mode and does not perform paging group based update.

Localized_Idle_Mode_Accepted flag set to 0, the M2M device enters the normal idle mode.

6.2.18.7.3.1 Idle mode operations for fixed M2M devices

When the fixed M2M device enters the idle mode, a Fixed M2M Deregistration ID (FMDID) is assigned to the fixed M2M device and Paging Controller ID, Paging Group ID and Deregistration ID is not required to be assigned to the fixed M2M device.

The ABS can page the fixed M2M devices via group paging or individual paging. When the ABS pages the fixed M2M devices via group paging, it transmits the AAI-PAG-ADV message with MGIDs to the fixed M2M devices. When the ABS individually pages the fixed M2M devices, it transmits the AAI-PAG-ADV message with FMDID to the fixed M2M devices.

PGID information of the PGID-Info message is not applicable to the fixed M2M device because the Paging Group ID is not assigned to the fixed M2M device.

Fixed M2M device does not perform the paging group based update because the Paging Group ID is not assigned to the fixed M2M device. Fixed M2M device performs the timer based update based on the M2M device-specific Idle Mode Timer.

6.2.19 Deregistration with context retention (DCR) mode

6.2.20 Co-located coexistence (CLC)

6.2.21 Interference mitigation mechanism

6.2.22 MAC control reliability

6.2.23 Power management for the active mode

6.2.24 Update of S-SFH IEs

6.2.25 Short message service

6.2.26 Coverage loss detection and recovery from coverage loss

6.2.27 AMS deregistration

6.2.28 Support for multicast service

Add new subclause 6.2.28.4 as indicated

6.2.28.4 Multicast operation for machine to machine (M2M) applications

Multicast Service for M2M applications provides an efficient method for concurrent transport of DL data common to M2M devices belonging to an M2M group using an MGID in an ABS. Multicast service is associated with an ABS and is offered in the downlink only. Each multicast connection is associated with a service flow provisioned with the QoS and traffic parameters for that service flow. Service flows to carry multicast data are instantiated on individual M2M devices participating in the service while in Connected State. During such instantiation, the M2M device learns the parameters that identify the service and associated service flows.

The ABS shall use a combination of MGID and FID to provide the multicast service. The same MGID and FID is assigned to a group of M2M devices that participate in the same multicast service and is assigned by a network during DSA procedure.

To access the multicast service, the M2M device that is assigned an MGID shall apply the 16-bit CRC mask with masking prefix = 0b0, message type indicator = 0b010, and decimal value = 4094 to decode the assignment A-MAP IE. If the MGID is included in the Broadcast Assignment A-MAP IE, the M2M device shall obtain the multicast burst according to the instruction in the Broadcast Assignment A-MAP IE.

6.2.28.4.1 Multicast operation

An ABS may establish a DL multicast service by creating a multicast connection with each M2M device to be associated with the service. Any available FID may be used for the multicast service (i.e., there are no dedicated FIDs for multicast transport connections). The multicast connection shall be established using a combination of MGID and FID assigned through AAI-DSA MAC control. Since a multicast connection is associated with a service flow, it is associated with the QoS and traffic parameters of that service flow. For multicast connections, ARQ is not applicable, but a common security key is used to provide encryption and integrity protection for multicast traffic as described in 6.2.5.5.

6.2.28.4.2 Multicast connection establishment

When an M2M device registers to receive multicast services, the S-ABS or the M2M device may initiate the DSA procedure for multicast connections. The M2M device's discovery and registration of multicast services with the ABS through upper layer signaling are outside the scope of this standard.

The AAI-DSC messages are used to change multicast service flows, but the multicast service flows are not deleted unless the M2M device exits from a network or enters DCR mode. The M2M device shall retain service flow information associated multicast service during idle mode if it supports DL multicast transmission during idle mode. The ABS shall send the AAI-DSA-REQ/RSP to the M2M device with the relevant multicast parameters including MGID.

6.2.28.4.3 M2M Multicast operation in idle mode

An M2M BS may provide the multicast service for M2M devices in idle mode with or without requiring network reentry of the M2M devices. Before an M2M BS sends DL multicast data, the M2M BS may transmit the paging message including the multicast traffic indication to M2M devices during the paging listening intervals of the M2M devices. If an M2M device receives the paging message indicating multicast traffic reception without network reentry during its paging listening interval, the M2M device shall start receiving the DL multicast data without the idle mode termination.

The multicast transmission start time may be included in the paging message in order to indicate when the DL multicast data is sent by the BS. The value of multicast transmission start time shall be less than the start time of next paging listening interval of the M2M devices receiving the AAI-PAG-ADV message. The M2M device may power down until the frame indicated by multicast transmission start time in the AAI-PAG-ADV message.

When the multicast data transmission ends, the BS shall signal the end of multicast data transmission to the M2M devices by sending the AAI-MTE-IND message. Upon receiving the AAI-MTE-IND message, the M2M devices may enter the paging unavailable interval as specified in 6.2.18.2.

6.2.28.4.4 Reliable multicast transmission for M2M applications

An M2M BS shall provide the reliable transmission of the multicast traffic for M2M applications.

Add new subclause 6.2.29 as indicated

6.2.29 Abnormal Power Down Reporting in Connected State

When a MS detects an abnormal power down event, it tries to send an AAI-RNG-REQ message with the Ranging Purpose Indication indicating that an abnormal or involuntary power down has occurred (value 0b1110).

If the MS is in connected state with uplink bandwidth already allocated and available, then it may use the available bandwidth to send this AAI-RNG-REQ message containing the Ranging Purpose Indication with value 0b1110.

If the MS is in connected state but does not have available UL bandwidth, then it may use the procedure defined in 6.3.6 to request bandwidth. Upon receiving bandwidth allocation it may send the AAI-RNG-REQ message containing the Ranging Purpose Indication with value 0b1110.

6.3 Physical layer

6.3.5 Downlink control structure

6.3.5.5 DL control information elements

6.3.5.5.1.2 S-SFH IE

Change the contents of Table 841 as indicated

Table 841—S-SFH SP3 IE format

Syntax	Size (bit)	Notes
...	...	...
M2M SCD count	4	The value is increased whenever the contents of the dedicated ranging information for M2M devices are changed. The value rolls over from 0 to 15. The operation of this field is same with SCD count as defined in 6.2.3.31.
...	...	...

6.3.5.5.2.4 Assignment A-MAP IE

Modify Table 851 as indicated

Table 851—Description of the masking code for type indicator 010

Decimal Value	Description
4094	Used to mask Broadcast Assignment A-MAP IE for multicast assignment for M2M application (i.e., Function Index = 0b11)
4095	Used to mask Broadcast Assignment A-MAP IE for multicast assignment (i.e., Function Index = 0b10)
Others	*Reserved*

6.3.5.5.2.4.7 CDMA Allocation A-MAP IE

Modify Table 859 as indicated

Table 859—CDMA Allocation A-MAP IE*

Syntax	Size (bits)	Notes
CDMA_Allocation_A-MAP IE {		
A-MAP IE type	4	CDMA Allocation A-MAP IE
CDMA allocation indication	1	0b0: Bandwidth allocation in response to a received contention-based bandwidth request. 0b1: Bandwidth allocation in response to a received contention-based ranging request
If (CDMA allocation indication ==0b0){		
...	...	...
}		
Else if (CDMA allocation indication ==0b1) {		
Uplink/Downlink Indicator	1	Indicates whether the following fields are for resource assignment in the uplink or in the downlink. 0b0: Uplink 0b1: Downlink
Resource Index	11	
ISizeOffset	5	
HFA	3	
If (Uplink/Downlink Indicator==0b0) {		
...	...	...
} Else {		
ACID	4	
AI_SN	1	
SPID	2	
~~Reserved~~	~~8~~	
MEF	1	MIMO encoder format 0b0: SFBC 0b1: Vertical encoding
if (MEF == 0b1){		
Mt	3	
Reserved	4	
} else {		
Reserved	7	

Table 859—CDMA Allocation A-MAP IE*

Syntax	Size (bits)	Notes
}		
}		
}		

Insert the following texts at the end of section 6.3.5.5.2.4.7

For M2M devices the DL HARQ burst signaled by the CDMA Allocation A-MAP IE is transmitted using MIMO encoder format and the modulation scheme indicated the CDMA Allocation A-MAP IE.

6.3.5.5.2.4.13 Broadcast Assignment A-MAP IE

Modify Table 866 as indicated

Table 866—Broadcast Assignment A-MAP IE*

Syntax	Size (bit)	Notes
Broadcast_Assignment_A-MAP_IE() {		
A-MAP IE Type	4	Broadcast Assignment A-MAP IE
Function Index	2	0b00: This IE carries broadcast assignment information 0b01: This IE carries handover ranging channel allocation information 0b10: This IE carries multicast assignment information 0b11: ~~reserved~~ This IE carries multicast assignment information for M2M application
...	...	...
} else if (Function Index ==0b10) {		
...	...	...
}		
Else {//Function Index == 0b11		
MGID	15	
Burst Size	6	
Resource Index	11	
Long_TTI_Indicator	1	
Reserved	1	
}		

*A 16 bit CRC is generated based on the randomized contents of the Broadcast Assignment A-MAP IE. The CRC is masked by the 16-bit CRC mask generated according to Table 849. If Function index == 0b00 or 0b01, the CRC is masked by the 16-bit CRC mask with masking prefix = 0b0 and message type indicator = 0b001. If Function index == 0b10 or 0b11, the CRC is masked by the 16-bit CRC mask with masking prefix = 0b0 and message type indicator = 0b010.

6.11 Global values

Change the contents of Table 982 as indicated

Table 982—Parameters and constants

System	Name	Time reference	Minimum value	Default value	Maximum value
AMS	T59	Time interval between periodic ranging for fixed M2M devices	-	-	TBD