IEEE P802.16p AWD

~~DRAFT Amendment to IEEE Standard for Local and metropolitan area networks~~

~~Part 16: Air Interface for Broadband Wireless Access Systems~~

Enhancements to Support Machine-to-Machine Applications

~~Sponsor~~

~~LAN/MAN Standards Committee~~
~~of the~~
~~IEEE Computer Society~~

~~and the~~

~~IEEE Microwave Theory and Techniques Society~~

Introduction

This introduction is not part of IEEE Std 802.16p, IEEE Standard for Local and metropolitan area networks—Part 16: Air Interface for Broadband Wireless Access Systems - Amendment: Air Interface for Broadband Wireless Access Systems – Enhancements to Support Machine-to-Machine Applications.

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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IEEE Standards Program Manager, Technical Program Development

3. Definitions

Add the following definitions:

3.148 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.

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

3.150 M2M device: An MS with M2M functionality.

3.151 M2M subscriber: A consumer of M2M service.

3.152 M2M Server: An entity to communicate with M2M devices. The M2M server provides an interface which can be accessed by an M2M subscriber.

3.153 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.

3.154 M2M group: A group of devices that share one or more features in common and/or belong to same M2M subscriber.

6. MAC common part sublayer

6.3 Data/Control plane

6.3.1 Addressing and connections

Insert the following texts at the end of subclause 6.3.1

M2M group ID (MGID) uniquely identifies an M2M group in the domain of the network entity that assigns MGID, which one or more M2M devices belong to. This ID shall be used to identify a group of devices (e.g., group paging).

An MGID is assigned to an M2M device during initial network entry and released during an explicit network exit (e.g., power down location update). The assigned MGID shall be retained by an M2M device even in idle state unless the M2M device exits from the network. The MGID can be re-assigned. During connected mode, the MGID may be added and changed by DSA and DSC procedure respectively.

6.3.2.3 MAC management messages

6.3.2.3.26 DREG-CMD (de/reregister command) message

Add the following texts at the end of subclause 6.3.2.3.26

When the DREG-CMD message is sent to an M2M device, the following TLV may be included:

M2M device-specific Idle mode timer

Length of the maximum interval between location update while the M2M device in idle mode

Add new subclause in 6.3.2.3 as indicated

6.3.2.3.60 M2M_POLL-ADV (M2M broadcast paging) message

The M2M_POLL-ADV message shall be sent on the Broadcast CID or Idle Mode Multicast CID during the BS paging interval. The M2M_POLL-ADV is to be broadcast on the same downlink frame as MOB_PAG-ADV, so the devices can receive the message after waking up from the idle mode.

The format of the message is shown in Table 166a.

Table 166a—M2M_POLL-ADV message format

Syntax	Size (bits)	Notes
M2M_POLL-ADV_Message_format() {		
Management Message Type = 70	-	-

Table 166a—M2M_POLL-ADV message format

Syntax	Size (bits)	Notes
Num_M2M_Devices	8	Number of M2M devices
For (j = 0; j < Num_M2M_Devices; j++) {		
M2M device MAC Address hash	24	The hash is obtained by computing a CRC24 on the MS 48-bit MAC address. The polynomial for the calculation is 0x1864CFB.
M2M action code	1	Indicate the opportunity for the M2M device to send the uplink data 0b0: No action required 0b1: Send uplink data
Reserved	7	
}		

6.3.23 MS idle mode (optional)

Add new subclause 6.3.23.10

6.3.23.10 MS idle mode for M2M application

M2M device-specific Idle mode timer for an M2M device may be assigned during idle mode initiation. In this case, the DREG-CMD message includes M2M device-specific Idle mode timer as 11.14.1. A network entity administering idle mode activity for the M2M device shall maintain idle mode system timer corresponding to M2M device-specific Idle mode timer to retain the M2M device's service and operational information. When the M2M device receives the DREG-CMD message with M2M device-specific Idle mode timer, the M2M device shall periodically 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.

Add new subclause 6.3.23.10.1

6.3.23.10.1 Network reentry 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. If BS does not assign dedicated ranging resources, M2M devices perform ranging for network (re-)entry using the ranging resources defined in 6.3.10.3.

Add new section after subclause 6.3.27

6.3.28 Support of multicast operation for machine to machine application

6.3.28.1 M2M multicast operation in idle mode

A BS may provide a multicast service for M2M devices in idle mode with or without requiring network reentry of the M2M devices. Before a BS sends DL multicast data, the 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 TLV 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 TLV shall be less than the start time of the next paging listening interval of the devices receiving the MOB_PAG-ADV message. The M2M device may power down until the frame indicated by the Multicast transmission start time TLV in the MOB_PAG-ADV message.

8. Physical layer (PHY)

8.4.5.4.4 UL-MAP Extended IE

8.4.5.4.4.1 UL-MAP Extended IE format

Modify Table 381 as indicated

Table 381—Extended UIUC code assignment for UIUC = 15

Extended UIUC (hexadecimal)	Usage
0x0	Power Control IE
0x1	*Reserved*
0x2	AAS UL IE
0x3	CQICH Allocation IE
0x4	UL Zone IE
0x5	UL-MAP Physical Modifier IE
0x6	*Reserved*
0x7	UL-MAP Fast Tracking IE
0x8	UL PUSC Burst Allocation in Other Segment IE
0x9	Fast Ranging IE
0xA	UL Allocation Start IE
0xB	Dedicated Ranging Channel for M2M IE
0x~~B~~C ... 0xF	*Reserved*

Add new subclause as indicated

8.4.5.4.4.30 M2M Ranging Allocation UL-MAP Extended IE format

The M2M Ranging Allocation UL-MAP Extended IE is used to indicate if the allocated ranging channel is used for M2M devices.

Table 426a—M2M Ranging Allocaiton UL-MAP Extended IE format

Syntax	Size (bit)	Notes
M2M Ranging Allocation UL-MAP Extended IE(){	-	-

Table 426a—M2M Ranging Allocaiton UL-MAP Extended IE format

Syntax	Size (bit)	Notes
Extended UIUC	4	M2M Ranging Allocation UL-MAP Extended = 0xB
Length	4	Length is TBD
OFDMA Symbol offset	8	-
Subchannel offset	7	-
No. OFDMA Symbols	7	-
No. Subchannels	7	-
Ranging Method	2	0b00: Initial ranging/Handover Ranging over two symbols 0b01: Initial ranging/Handover Ranging over four symbols 0b10-0b11: reserved
Dedicated ranging indicator	1	0: The OFDMA region and ranging method defined are used for the purpose of normal ranging 1: The OFDMA region and ranging method defined are used for the purpose of ranging using dedicated CDMA code and transmission opportunities assigned in the MOB_PAG-ADV message
M2M Dedicated Ranging Allocation Indicator	1	When this bit is set to 1, the ranging allocation defined by OFDMA UL-MAP IE format shall not be used by M2M devices
}		

11. TLV encodings

11.3 UCD management message encodings

11.3.1 UCD channel encodings

Add a new parameter at the end of Table 568 as indicated

Table 568—UCD channel encodings

Name	Type (1 byte)	Length	Value
M2M Ranging Region	25	6	Bit 0: dedicated ranging indicator Bits 1-2: ranging method Bits 2-9: num subchannels Bits 10-16: num OFDMA symbols Bits 17-23: subchannel offset Bits 24-31: OFDMA symbol offset Bits 32-34, Parameter d that defines periodicity of 2^d frames Bits 35-39, Allocation phase expressed in frames, $0 \le \text{Allocation Phase} < periodicity (= 2^d)$ Bit 40, When this bit is set to 1, the ranging allocation defined by Ranging Region TLV Type = 212 shall not be used by M2M devices Bits 41-47, Reserved

11.14 DREG-CMD/REQ message encodings

Add a new section at the end of 11.14

11.14.1 M2M device-specific Idle mode timer

Name	Type	Length	Value	Scope
M2M device-specific Idle mode timer	53	3	Length of the maximum interval between location update while the M2M device in idle mode	DREG-CMD

11.17 MOB_PAG-ADV management message encodings

Insert new subclause after subclause 11.17.2

11.17.3 M2M group paging parameter

The following M2M group paging parameter TLV may be included in MOB_PAG-ADV message.

Name	Type	Length	Value	Scope
M2M group paging parameter	153	Variable	Compound TLV to be used in M2M group paging operation	MOB_PAG-ADV

The following TLV element shall appear in each M2M group paging parameter TLV.

Name	Type	Length	Value
MGID	153.1	2	Bits 0-14: Indicates M2M Group ID; Bit 15: Padding, Will be set to 0
Action code	153.2	1	Bits 0-1: Indicates Action code for the M2M Group ID 0b00 - Performing network reentry 0b01- Performing location update 0b10 - Receiving multicast traffic 0b11- *Reserved* Bits 2-7: Padding, Will be set to 0

The following TLV element may appear in each M2M group paging parameter TLV.

Name	Type	Length	Value
Multicast transmission start time (MTST)	153.3	1	Least significant 8 bits of the frame number in which the ABS starts sending DL multi-cast data

16. WirelessMAN-Advanced Air Interface

16.1 Introduction

16.2 Medium access control

16.2.1 Addressing

16.2.1.2 Logical Identifiers

16.2.1.2.1 Station Identifier (STID)

Insert the following texts at the end of the first paragraph of 16.2.1.2.1

The STID is also used to identify the M2M devices in the domain of the ABS.

Insert new subclause as indicated

16.2.1.3 Address for machine to machine application

16.2.1.3.1 M2M Group Identifier (MGID)

A 15-bit value that uniquely identifies an M2M group in the domain of the network entity that assigns MGID, which one or more M2M devices belong to. This ID is used to identify a group of M2M devices.

An MGID is assigned to an M2M device by a network entity during initial network entry and released during an explicit network exit (e.g., power down location update) or when the device enters DCR mode. The MGID assignment procedure and release procedure are TBD. The assigned MGID shall be retained by an M2M device even in idle state unless the M2M device exits from the network. The MGID can be re-assigned. During connected mode, the MGID may be added and changed by DSA and DSC procedure respectively.

16.2.2 MAC PDU formats

16.2.3 MAC Control messages

16.2.3.1 AAI-RNG-REQ

Modify Table 678 as indicated

Table 678—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 - 0b1111 = reserved	
...	...		...
} else if (Ranging Purpose Indication == 0b0010) {			
if (S-SFH Network Configuration bit == 0b1 or AMSID privacy is disabled){			
AMS MAC address	48		
} else{			
Deregistration Identifier (DID)	18		
}			
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)	

Table 678—AAI-RNG-REQ Message Field Description

Field	Size (bits)	Value	Condition
}			
Paging Controller ID			
...			
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)	
...	...		...

16.2.3.2 AAI-RNG-RSP

Modify Table 679 as indicated

Table 679—AAI-RNG-RSP message Field Description

Field	Size (bits)	Value/Description	Condition
...		...	...
Unsolicited bandwidth grant indicator	1	1: indicates an unsolicited BW grant will be available for transmission of BR header without request from AMS during network entry or 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 bandwidth request indicator is included in AAI-RNG-REQ when M2M device is attempting network reentry from idle mode
...		...	...

16.2.3.22 AAI-DREG-RSP message

Modify Table 699 as indicated

Table 699—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 699—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 which manages and retains the AMS's idle mode information $0..2^{48}-1$	
Paging group ID	16	Used to indicate Paging group which 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 699—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 of the maximum interval between location update while the M2M device 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 699—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 which manages and retains the AMS's idle mode information $0..2^{48}-1$	
Paging group ID	16	Used to indicate Paging group which 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 699—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 of the maximum interval between location update while the M2M device 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 16.2.18.7.1. The unit is the duration of the paging cycle.	Present if Transmission Type is set to 1
}			

16.2.3.23 AAI-PAG-ADV (paging advertisement) Message

Modify Table 700 as indicated

Table 700—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 re entry 0b01: Performing location update 0b10: Receiving multicast traffic 0b11: reserved	
M2M report code	1	Indicate the opportunity for the M2M device to send the uplink report 0b0: No action required 0b1: Send uplink report	Present if M2M is supported
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.
}			
...	...	...	...
}			

16.2.3.24 PGID-Info (paging group information) Message

Modify Table 701 as indicated

Table 701—PGID-Info Message Field Description

Field	Size(bits)	Value/Description	Condition
For(i=0;i<Num_PGIDs; i++){			
PGID	16		

Table 701—PGID-Info Message Field Description

Field	Size(bits)	Value/Description	Condition
m	2		
Group paging indicator	1	Indicate the location of group paging message. 0: the first among frames determined by the value of 'm' 1: the last among frames determined by the value of 'm'	Present when group paging is supported.
}			
...			
} // End If (an ABS supports multiple carrier operation)			
Paging Message Indication	1	1: Paging message which is notifying the M2M devices will not be transmitted in the current superframe.	This parameter shall be presented when the paging message does not transmit in the current superframe. This parameter is only useful for the M2M device.

16.2.3.31 AAI-System Configuration Descriptor (SCD) Message

Add a new parameter at the end of Table 708 as indicated

Table 708—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.	

16.2.3.47 DSx MAC Control Message

16.2.3.47.1 AAI-DSA-REQ

Add new paramter at the end of Table 734 as indicated

Table 734—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.

16.2.3.47.4 AAI-DSC-REQ

Add new parameter at the end of Table 737 as indicated

Table 737—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

16.2.4 Construction and Transmission of MAC PDUs

16.2.5 AAI Security

Add new section as indicated

16.2.5.5 Security Support for Multi-cast Traffic

Security for Multi-cast traffic provides encryption and integrity protection of such data information for secure group informing and management. A common security key is used by devices within a group.

16.2.5.5.1 Key Derivation

The key hierarchy defines what keys are present in the system for Multi-cast traffic and how keys are generated. The BS may derive the Group Master Key (GMK) from the M2M authentication server or generate it locally. The group traffic encryption key (GTEK) is derived directly from the GMK.

16.2.5.5.1.1 GTEK Derivation

The GTEK is the transport encryption key used to encrypt Multi-cast data. The GTEK (Group Traffic Encryption Key) is derived based on the GMK (Group Master Key). The GMK is provided by the ABS during the network entry through the AAI-REG-RSP message, which also includes GTEK_COUNT and MGID.
The GTEK derivation is done:

GTEKi = Dot16KDF (GMK, MGID, GTEK_COUNT | “GTEK”, 128), (1)

Where:

- GMK is the Group Master Key.
- GTEK_COUNT is a counter used to derive different GTEKs for the same GMK, the value of the counter is changed every time a new GTEK need to be derived within the time the same GMK is valid.
- MGID is the identifier of the group, which the AMS and GMK is associated with

16.2.5.5.2 Key Hierarchy

Figure 411a outlines the process to calculate the GTEK based on a GMK provided by the ABS.

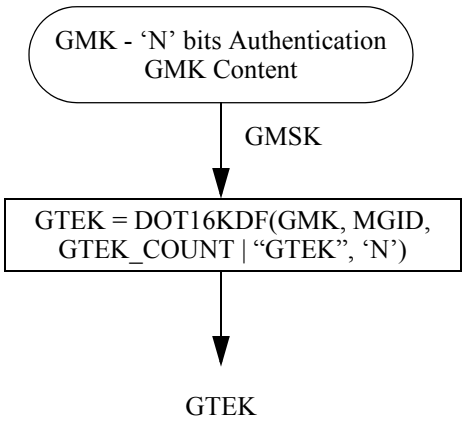

Figure 411a—GTEK derivation from GMK

16.2.5.5.3 GTEK Key Usage

The GTEK is used for encrypting DL multi-cast data by the ABS, which is also used for decrypting such DL multi-cast data by the AMS.

Each GTEK has its own PN counter size of 22 bits.

16.2.5.5.3.1 GTEK Update

The GTEK update is triggered whenever GTEK is running out the relevant PN space.

16.2.5.5.3.2 Key Update during Location Update

The AMS shall include its current GTEK_COUNT in the AAI-RNG-REQ message during location update to the ABS. If ABS detects that the AMS has an old GTEK_COUNT, the ABS shall include the current GTEK_COUNT of the GMK in the AAI-RNG-RSP message and send it to the AMS. Otherwise, no GTEK update will be performed.

16.2.5.5.3.3 Key Update during Handover

During handover, the serving ABS shall include the new GTEK information via AAI-HO-MCD message, if the MGID of the AMS changes. If the MGID does not change for AMS, the serving ABS shall indicate that no change of GTEK is required.

16.2.6 MAC HO procedures

16.2.7 Persistent Scheduling in the Advanced Air Interface

16.2.8 Multicarrier operation

16.2.9 Group Resource Allocation

16.2.10 Connection Management

16.2.11 Bandwidth Request and Allocation Mechanism

16.2.12 Quality of Service (QoS)

16.2.13 ARQ mechanism

16.2.14 HARQ functions

16.2.15 Network entry and initialization

16.2.16 Periodic ranging

16.2.17 Sleep mode

16.2.18 Idle mode

Add new section and text

16.2.18.7 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 16.2.18, 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.

16.2.18.7.1 Paging operation

Group paging may be used for M2M devices. For this, M2M Group Identifier (MGID) defined in 16.2.1.3.1 may be included in a paging message instead of an individual identifier to identify the group of M2M devices. In order to ensure that group paging message is received correctly, the 16p BS shall transmit the location information of the paging message including M2M Group Identifiers (MGIDs). A M2M device

which is belongs to one or more M2M groups shall monitor the pre-determined frame for group paging based on the location information described by Group paging indicator in PGID-Info message.

Paging Message Indication of PGID-Info message may be used for M2M devices. When the ABS does not have the AAI-PAG-ADV message for notifying the M2M devices in the current superframe, Paging Message Indication is set to 1. If the M2M device checks that Paging Message Indication is set to 1 in the PGID-Info message, M2M device shall not decode the AAI-PAG-ADV message during the Paging Listening Interval and return to the Paging Unavailable Interval.

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

16.2.18.7.2 Network re-entry from idle mode for M2M devices

For network reentry from Idle Mode, ranging parameters may be different for M2M devices or M2M groups.

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 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. 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 16.3.5.5.1.2.

For the network reentry indicated by a paging message that contains ranging configuration, the M2M device shall select a ranging opportunity according to the ranging configuration. Ranging configuration may include differentiated waiting offset time and backoff window size.

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 receiving 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 shall 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.

16.2.19 Deregistration with context retention (DCR) mode

16.2.20 Co-located coexistence (CLC)

16.2.21 Interference mitigation mechanism

16.2.22 MAC control reliability

16.2.23 Power management for active mode

16.2.24 Update of S-SFH IEs

16.2.25 Short Message Service

16.2.26 Coverage Loss Detection and Recovery from Coverage Loss

16.2.27 AMS deregistration

16.2.28 Support for Multicast Service

Add new section as indicated

16.2.28.4 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.

16.2.28.4.1 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 16.2.5.5.

16.2.28.4.2 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 ser-

vice 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.

16.2.28.4.3 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 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.

16.2.28.4.4 Reliable multicast transmission for M2M applications

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

16.3 Physical layer

16.3.5 Downlink control structure

16.3.5.5 DL Control Informaiton Elements

16.3.5.5.2.4 Assignment A-MAP IE

Modify Table 845 as indicated

Table 845—Descriptoin 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

16.3.5.5.2.4.7 CDMA Allocation A-MAP IE

Modify Table 853 as indicated

Table 853—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) {		

Table 853—CDMA Allocation A-MAP IE*

Syntax	Size (bits)	Notes
Uplink/Downlink Indicator	1	Indicates whether the following fields are for resource assignment in the uplink or in the down-link. 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	
}		
}		
}		

Insert the following texts at the end of section 16.3.5.5.2.4.7

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.

16.3.5.5.2.4.13 Broadcast Assignment A-MAP IE

Modify Table 860 as indicated

Table 860—Broadcast Assignment A-MAP IE*

Syntax	Size (bit)	Notes
Broadcast_Assignment_AMAP_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 843. 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.