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

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

IEEE Computer Society

and the

IEEE Microwave Theory and Techniques Society

Sponsored by the
LAN/MAN Standards Committee

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

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

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Introduction

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

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

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

NOTE—The editing instructions contained in this amendment define how to merge the material contained therein into the existing base standard and its amendments to form the comprehensive standard.

The editing instructions are shown in ***bold italic***. Four editing instructions are used: change, delete, insert, and replace. ***Change*** is used to make corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using ~~strikethrough~~ (to remove old material) and underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Deletions and insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is used to make changes in figures or equations by removing the existing figure or equation and replacing it with a new one. Editing instructions, change markings, and this NOTE will not be carried over into future editions because the changes will be incorporated into the base standard.[1]

[1]Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement the standard.

1. Overview

Insert new subclause 1.5:

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

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

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

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

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

3. Definitions

Insert the following definitions in alphabetical order:

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

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

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

M2M feature: A unique characteristic of an M2M application.

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

6. WirelessMAN-Advanced Air Interface

6.2 Medium access control

6.2.1 Addressing

6.2.1.2 Logical identifiers

6.2.1.2.1 Station identifier (STID)

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

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

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

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

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

Insert new subclause 6.2.1.3 as indicated:

6.2.1.3 Address for machine-to-machine application

Insert new subclause 6.2.1.3.1 as indicated:

6.2.1.3.1 M2M Group Identifier (MGID)

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

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

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

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

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

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

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

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

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

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

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

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

Insert new subclause 6.2.1.3.2 as indicated:

6.2.1.3.2 Fixed M2M Deregistration ID (FMDID)

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

6.2.2 MAC PDU formats

6.2.2.1.3 MAC signaling header

Change the contents of Table 6-5 as indicated:

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

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

Insert new subclause 6.2.2.1.3.10:

6.2.2.1.3.10 M2M Bandwidth request (BR) with STID header

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

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

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

Insert new subclause 6.2.2.1.3.11:

6.2.2.1.3.11 M2M abnormal power down report header

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

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

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

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

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

Insert new subclause 6.2.2.1.3.12:

6.2.2.1.3.12 M2M abnormal power down confirmation header

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

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

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

6.2.3 MAC Control messages

Change Table 6-28 as indicated:

Table 6-28—MAC Control messages

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

6.2.3.1 AAI-RNG-REQ

Change Table 6-29 as indicated:

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

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

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

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

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

Field	Size (bits)	Value	Condition
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) is 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-flag is set to 1 in the AAI-DREG-REQ/RSP message, Paging Controller ID shall not be included in this message.
...			
Bandwidth Request Size	11	Amount of bandwidth requested in bytes	Shall be present when M2M device that performs network reentry requests bandwidth for UL data to be transmitted after completion of the current network reentry.
} else if (Ranging Purpose Indication == 0b0011 |0b0110|0b0111| 0b1011) {		// Idle mode location update (and with other additional purposes)	
...	...	...	...
M2M short data burst encryption indicator	1	Indicate that the included M2M short data burst is encrypted. 0b0: Not encrypted 0b1: Encrypted	Shall be present if M2M device includes M2M short data burst in this message.
Current-M2M-GROUP-ZONE-ID	12	M2M-GROUP-ZONE-ID for the current MGID	Shall be present when an M2M device requests MGID update during location update or network reentry if the M2M device does not have the information of new M2M Group Zone.
For (i = 0; i < Num-MGID; i++){			
Current-MGID	12	Current MGID	Shall be present when an M2M device requests MGID update during location update or network reentry if the M2M device does not have the information of new M2M Group Zone.
}			

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

Field	Size (bits)	Value	Condition
MGID acknowledgment indication	1	Indicate that new MGID was received successfully	Shall be present when the M2M device sends this message to acknowledge the reception of new MGID included in the AAI-PAG-ADV message.
}~~//end of Ranging Purpose Indication~~ else if (Ranging Purpose Indication == 0b1111) {			
if (Ranging Purpose Indicator Extension == 0b000) {		//Abnormal or involuntary power down	
}			
}//end of Ranging Purpose Indication			
...	...	...	...
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 fourth or later attempt	Shall be present when an M2M device is configured to report statistics of initial ranging during network entry or reentry, periodic ranging, or HO ranging.

6.2.3.2 AAI-RNG-RSP

Change Table 6-30 as indicated:

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

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

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

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

6.2.3.3 AAI-RNG-ACK

Insert the following text before Table 6-31:

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

6.2.3.8 AAI-REG-REQ

Change the contents of Table 6-36 as indicated:

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

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

6.2.3.9 AAI-REG-RSP

Change the contents of Table 6-37 as indicated:

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

Field	Size (bits)	Value/Description	Condition
...	...	...	...
Support of STID Sharing	1	0: STID sharing is not supported 1: STID sharing is supported	Shall be included when an M2M device is performing initial network entry.
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	If support of STID sharing is supported by M2M device and the ABS, this parameter shall be included when an M2M device is performing initial network entry or an M2M device has no STID pre-assigned when it is performing a network reentry procedure (see 6.2.15).

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

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

6.2.3.13 AAI-NBR-ADV

Change Table 6-41 as indicated:

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

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

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

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

6.2.3.21 AAI-DREG-REQ message

Change Table 6-49 as indicated:

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

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

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

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

6.2.3.22 AAI-DREG-RSP message

Change Table 6-50 as indicated:

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

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

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

Field	Size (bits)	Value/Description	Condition
Localized-Idle-Mode-flag	1	0: The M2M device enters the normal idle mode. 1: The M2M device enters the localized idle mode.	This parameter shall be present when the fixed M2M device enters the idle mode and when the localized idle mode is supported by the ABS.
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: 32 768 superframes 0x09: 262 144 superframes 0x10: 4 194 304 superframes 0x11~~08~~–0x15: *Reserved*	
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.	Shall be present when the Paging cycle value is set to 0x08, 0x09, or 0x10 and the paging offset of an M2M device is set to a value longer than 2048 superframes.
Paging controller ID	48	Used to indicate Paging controller that manages and retains the AMS's idle mode information $0..2^{48}-1$	For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b0
Paging group ID	16	Used to indicate Paging group that the AMS is located in $0..2^{16}-1$	For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b0
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. For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b0.

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

Field	Size (bits)	Value/Description	Condition
Fixed M2M Deregistration ID (FMDID)	16	Fixed M2M Deregistration ID	For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b1.
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	Shall be present when the M2M device enters idle mode and an ABS assigns a long interval for timer based location update
}			
If (Action Code == 0x06) {			
REQ-Duration	8	Used to indicate waiting value for the AAI-DREG-REQ message with De-registration_Request_Code = 0x01 0..2^8– 1: measured in frames	Present if needed
}			

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

Field	Size (bits)	Value/Description	Condition
If (Action Code == 0x07) {			
Localized-Idle-Mode-flag	1	0: The M2M device enters the normal idle mode. 1: The M2M device enters the localized idle mode.	This parameter shall be present when the fixed M2M device enters the idle mode and when localized idle mode is supported by the ABS.
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: 32 768 superframes 0x09: 262 144 superframes 0x10: 4 194 304 superframes 0x11~~08~~–0x15: *Reserved*	
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.	Shall be present when the second paging offset is assigned to the M2M device (see 6.2.18.7.1)
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/Second paging offset field. M2M paging offset shall be interpreted as the MSB. Shall be smaller than Paging cycle value.	Shall be present when the Paging cycle value is set to 0x08, 0x09, or 0x10 and the paging offset of an M2M device is set to a value longer than 2048 superframes
Paging controller ID	48	Used to indicate Paging controller that manages and retains the AMS's idle mode information $0..2^{48}-1$	For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b0
Paging group ID	16	Used to indicate Paging group that the AMS is located in $0..2^{16}-1$	For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b0

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

Field	Size (bits)	Value/Description	Condition
Deregistration ID	18	Used to indicate Deregistration ID used to identify the AMS in idle mode $0..2^{18}-1$	Present when the S-SFH Network Configuration bit == 0b0. For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b0.
Fixed M2M Deregistration ID (FMDID)	16	Fixed M2M Deregistration ID	For fixed M2M devices, this parameter is present only when the Localized-Idle-Mode-flag == 0b1.
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	Shall be present when the M2M device enters idle mode and the ABS assigns a long interval for timer based location update
Transmission Type	1	0: *Reserved* 1: Allowed to send data only after receiving paging message with M2M report code 0b1	Shall be present when the ABS requests an M2M device to send data only after receiving paging message with M2M report code set to 0b01 (see 6.2.18.7.1)

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

Field	Size (bits)	Value/Description	Condition
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.	Shall be present if Transmission Type is set to 1
}			

6.2.3.23 AAI-PAG-ADV (paging advertisement) message

Change Table 6-51 as indicated:

Table 6-51—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 bit-map whose bit is set to 1.	Present only for M2M devices
For (j = 0; j < Num-devices; j++) {		Num-devices indicates the number of paged M2M devices in a corresponding paging group 1..32	
Deregistration Identifier	18	Used to indicate Deregistration ID for the M2M device to be paged (Deregistration Identifier and Paging Cycle are used to identify each paged M2M device) 0..2^{18} – 1	Shall be present if the S-SFH Network Configuration bit == 0b0
MAC Address Hash	24	Used to identify the M2M device to be paged	Shall be present if the S-SFH Network Configuration bit == 0b1
Paging Cycle	4	Used to indicate Paging cycle for the M2M device 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 0x11–0x15: *Reserved*	Shall be present if the S-SFH Network Configuration bit == 0b0

Table 6-51—AAI-PAG-ADV message field description *(continued)*

Field	Size (bits)	Value/Description	Condition
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 network access type	2	Indicate the network access type for M2M device; 0b00: Resource allocation (i.e., Fixed M2M Ranging Assignment A-MAP offset) for AAI-RNG-REQ 0b01: Dedicated ranging channel allocation in AAI-PAG-ADV 0b10: Dedicated ranging channel allocation in broadcast assignment A-MAP IE 0b11: No dedicated ranging channel	
If (M2M network access type == 0b00) {			
Fixed M2M Ranging Assignment A-MAP offset for AAI-RNG-REQ	8	Indicates the offset in units of frames of the Fixed M2M Ranging Assignment A-MAP IE for the AAI-RNG-REQ message, where the reference point of this offset value is the frame in which the AAI-PAG-ADV is transmitted.	
}			
M2M Report code	1	Indication for the M2M device to send the uplink report 0b0: *Reserved* 0b1: Send uplink report	Shall be present if polling of UL report is supported by M2M device and ABS.
} // End of for (j = 0; j < Num-devices; j++)			
} // End of for (i = 0; i < M; i++) {			

Table 6-51—AAI-PAG-ADV message field description *(continued)*

Field	Size (bits)	Value/Description	Condition
Initial ranging backoff start	4	Indicate the initial backoff window size for M2M devices. This parameter is applied for all M2M devices that are individually instructed to perform network reentry or location update by this message.	Shall be present if there is at least one M2M device that is individually instructed to perform network reentry or location update by this message and the ABS assigns a new initial ranging backoff start that is different from one assigned by S-SFH SP2.
Ranging backoff window indicator	1	0b0: Increasing the ranging backoff window size by a factor of 2 per every ranging retry 0b1: Decreasing the ranging backoff window size by a factor of 2 per every ranging retry as described in 6.2.18.7.2	Shall be present if Initial ranging backoff start field for individual paging is present.
For (i = 0; i < Num-MGID; i++) {		Num-MGID indicates the number of MGIDs included in this paging message [0..63]	Shall be present if there is at least one M2M group that is instructed to perform network reentry, location update, reception of multicast traffic, or MGID re-assignment by this message.
MGID	12	M2M Group ID	
M2M-Group-Zone-Index	2	Zone Index corresponding to an M2M-GROUP-ZONE-ID based on the implicit ordering of the M2M-GROUP-ZONE-IDs in the broadcasted message. It is derived based on the implicit ordering of the M2M-GROUP-ZONE-IDs in the AAI-SCD message transmitted by the ABS.	Shall be present if the ABS is part of more than one M2M Group Zone.
Action Code	2	0b00: Performing network reentry 0b01: Performing location update 0b10: Receiving multicast traffic without requiring network reentry 0b11: MGID re-assignment	
If (Action Code == 0b00 or 0b01) {			

Table 6-51—AAI-PAG-ADV message field description *(continued)*

Field	Size (bits)	Value/Description	Condition
Initial ranging backoff start	4	Indicate the initial backoff window size for M2M devices included in this group	Shall be present if there is at least one M2M device group that is instructed to perform network reentry or location update by this message and the ABS assigns a new initial ranging backoff start that is different from one assigned by S-SFH SP2.
Ranging backoff window indicator	1	0b0: Increasing the ranging backoff window size by a factor of 2 per every ranging reentry 0b1: Decreasing the ranging backoff window size by a factor of 2 per every ranging reentry as described in 6.2.18.7.2	Shall be present if Initial ranging backoff start field for group paging is present
M2M network access type	2	Indicate the network access scheme for M2M device 0b00: Resource allocation (i.e., Fixed M2M Ranging Assignment A-MAP offset) for AAI-RNG-REQ, This type is only applicable to fixed M2M device (i.e., Localized_Idle_Mode flag was set to 1 at the idle mode initiation). Except fixed M2M device, mobile M2M device shall perform the contention-based ranging. 0b01: Dedicated ranging channel allocation, S-RCH 0b10: Dedicated ranging channel allocation, NS-RCH 0b11: No dedicated ranging channel	
If (M2M network access type == 0b01 | 0b10) {			
Group paging change count	2	Group paging change count The value is increased whenever the whole M2M group is paged in a new round; the value rolls over from 0 to 3.	Shall be present if iterative group paging based on Group Access Probability is supported (see 6.2.18.7.2)
Group access probability	2	0b00:25% 0b01:50% 0b10:100% 0b11: *Reserved*	Shall be present if iterative group paging based on Group Access Probability is supported (see 6.2.18.7.2)

Table 6-51—AAI-PAG-ADV message field description *(continued)*

Field	Size (bits)	Value/Description	Condition
M2M ranging opportunity subframe index	3	Indicates the subframe index of the allocated ranging opportunity dedicated for M2M devices.	Shall be present if the ABS allocates ranging resource dedicated for M2M devices using this message.
Periodicity of the M2M ranging	3	Indicates the periodicity 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*	Shall be present if the ABS allocates ranging resource dedicated for M2M devices using this message.
Dedicated Channel Allocation Timer	8	Time duration in which dedicated channel allocation (i.e., M2M ranging opportunity subframe index, Periodicity of the M2M ranging) is valid.	Shall be included if the ABS allocates dedicated ranging channels in addition to the ranging channels allocated by the SCD to the M2M devices paged through the AAI-PAG-ADV message.
}			
If (M2M network access type == 0b00) {			
Fixed M2M Ranging Assignment A-MAP start offset for AAI-RNG-REQ	8	This parameter indicates the offset in units of frames that M2M device starts to monitor the resource (i.e., Fixed M2M Ranging Assignment A-MAP IE) for the AAI-RNG-REQ message, where the reference point of this offset value is the frame in which the AAI-PAG-ADV is transmitted.	
Resource monitor timer	8	Time duration that M2M device monitors the resource (i.e., Fixed M2M Ranging Assignment A-MAP IE) for the AAI-RNG-REQ message.	

Table 6-51—AAI-PAG-ADV message field description *(continued)*

Field	Size (bits)	Value/Description	Condition
}			
} // End of if (Action code == 0b00 or Action code == 0b01) {			
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 ABS is aware of when to start sending DL multicast data.
}			
If (Action Code == 0b11) {			
New-MGID	12	New MGID	
M2M-Group-Zone-Index	2	M2M-Group-Zone-Index of the corresponding M2M-GROUP-ZONE-ID that the MGID belongs to. It is derived based on the implicit ordering of the M2M-GROUP-ZONE-IDs in the AAI-SCD message transmitted by the ABS.	Shall be present if the ABS is part of more than one M2M Group Zone.
}			
}			
For (j = 0; j < Num-FMDID; j++) {		Num_FMDID indicates the number of FMDIDs included in this paging message [1..32]	Shall be present when the ABS pages the fixed M2M devices in localized idle mode.
Fixed M2M Deregistration ID (FMDID)	16	Fixed M2M Deregistration ID	
Action Code	1	0: Performing network reentry 1: Performing location update	
M2M report code	1	Indication for the M2M device to send the uplink report 0b1: Send uplink report	Shall be present if polling of UL report is supported by M2M device and ABS (see 6.2.18.7.1)

Table 6-51—AAI-PAG-ADV message field description *(continued)*

Field	Size (bits)	Value/Description	Condition
M2M network access type	2	Indicate the network access type for the M2M device; 0b00: Resource allocation (i.e., Fixed M2M Ranging Assignment A-MAP offset) for AAI-RNG-REQ 0b01: Dedicated ranging channel allocation in AAI-PAG-ADV 0b10: Dedicated ranging channel allocation in broadcast assignment A-MAP IE 0b11: No dedicated ranging channel	
If (M2M network access type == 0b00) {			
Fixed M2M Ranging Assignment A-MAP offset for AAI-RNG-REQ	8	Indicate the offset in units of frames that the M2M device starts to monitor the resource (i.e., Fixed M2M Ranging Assignment A-MAP IE for the AAI-RNG-REQ message is transmitted, where the reference point of this offset value is the frame in which the AAI-PAG-ADV is transmitted.	
}			
} // End of for (j = 0; j < Num-FMDID; j++)			
M2M ranging opportunity subframe index	3	Indicates the subframe index of the allocated ranging opportunity dedicated for M2M devices.	Optional, This parameter shall be present if the M2M network access type of individually paged M2M devices is set to 0b01.

Table 6-51—AAI-PAG-ADV message field description *(continued)*

Field	Size (bits)	Value/Description	Condition
Periodicity of the M2M ranging	3	Indicates the periodicity 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*	Optional, This parameter shall be present if the M2M network access type of individually paged M2M devices is set to 0b01.
Dedicated Channel Allocation Timer	8	Time duration in which dedicated channel allocation (i.e., M2M ranging opportunity subframe index, Periodicity of the M2M ranging) is valid.	Shall be included if the ABS allocates dedicated ranging channels in addition to the ranging channels allocated by the AAI-SCD to the M2M devices paged through the AAI-PAG-ADV message and if the M2M network access type is set to 0b01 (i.e., dedicated ranging channel allocation in AAI-PAG-ADV).

Table 6-51—AAI-PAG-ADV message field description *(continued)*

Field	Size (bits)	Value/Description	Condition
Extension Flag	1	Used to indicate the remaining part of the AAI-PAG-ADV message exists 0b0: This is the last fragment of the AAI-PAG-ADV message 0b1: This is not the last fragment of the AAI-PAG-ADV message; the remaining fragments of the message will be transmitted in the subsequent subframes or frames. If there are remaining segments and the remaining segments include only the M2M device's paging, this flag is set to 0b0. If this flag is set to 0b0, the AMS enters the paging unavailable interval and the M2M device checks the M2M extension flag. If this flag is set to 0b1, the AMS and the M2M device shall remain awake and monitor the subsequent AAI subframe unless their identifiers are found in the received segments.	
Emergency Alert Indication	1	Used to indicate the presence of emergency information 0b0: *Reserved* 0b1: There is emergency information	Optional Present if there is emergency information
M2M extension flag	1	Used to indicate existence of the remaining part of the AAI-PAG-ADV message for the M2M device. 0b0: This is the last segment of the AAI-PAG-ADV message 0b1: This is not the last segment of the AAI-PAG-ADV message; the remaining segments of the message will be transmitted in the subsequent subframes or frames.	Optional Shall be present if the Extension Flag is set to 0b0 and if there are remaining segments for paging M2M devices only.

6.2.3.31 AAI-System Configuration Descriptor (SCD) message

Change the contents of Table 6-59 as indicated:

Table 6-59—AAI-SCD message field description

Field	Size (bits)	Value/Description	Condition
Configuration Change Count	4	The value is increased whenever the contents of this message except the dedicated ranging information for M2M devices are changed. The value rolls over from 0 to 15	
...			
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.	
M2M Configuration Change 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 the 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 6-184 in 6.3.5.5.1.2 0b01: Dedicated ranging for M2M devices 0b10: M2M devices are not allowed to perform network reentry (M2M cell bar) 0b11: *Reserved*	
If (M2M ranging indicator = 0b00) {			
restriction of Access class (i)	1	INTEGER (0..1)	Shall be present if access restriction of ranging channels is supported by the ABS and the M2M device (see 6.2.15.7)
restriction of Access class (i + 1)	1	INTEGER (0..1)	Shall be present if access restriction of ranging channels is supported by the ABS and the M2M device (see 6.2.15.7)
restriction of Access class (i + 2)	1	INTEGER (0..1)	Shall be present if access restriction of ranging channels is supported by the ABS and the M2M device (see 6.2.15.7)

Table 6-59—AAI-SCD message field description *(continued)*

Field	Size (bits)	Value/Description	Condition
restriction of Access class (i + 3)	1	INTEGER (0..1)	Shall be present if access restriction of ranging channels is supported by the ABS and the M2M device (see 6.2.15.7)
}			
If ((M2M ranging indicator == 0b01) {			
M2M ranging opportunity subframe index	3	Indicates the subframe index of the allocated ranging opportunity dedicated for M2M devices.	Shall be present if an ABS assigns ranging resources dedicated for M2M devices
Periodicity of the M2M ranging	[3]	Indicates the periodicity 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*]	Shall be present if an ABS assigns ranging resources dedicated for M2M devices
}			
Probability threshold of M2M device group delegate selection	10	Probability threshold Value of quantized in 0.001 steps as from 0 to 1.	Shall be present when an ABS supports M2M GD Operation
For(i = 0; i < N-M2M-GROUP-ZONE; i++) {		N-M2M-GROUP-ZONE is the number of M2M-GROUP-ZONE-ID(s) that is assigned to the ABS [1..4].	Shall be present if one or more M2M-GROUP-ZONE-ID(s) are assigned to the ABS.
M2M-GROUP-ZONE-ID	12	M2M-GROUP-ZONE-ID that is assigned to the ABS.	
} // End of for (i = 0; i < N-M2M-GROUP-ZONE; i++)			

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

Change Table 6-71 as indicated:

Table 6-71—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	12	Multicast group identifier that the M2M device subscribes.	Shall be present when an M2M device is registered for M2M multicast service of the M2M device group and multicast SA for the associated multicast service is supported
}			

Change Table 6-72 as indicated:

Table 6-72—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*	
...			
If (PKM v3 message code == 9) {			
New-MGSS	64	A newly provided MGSS (M2M service Group Security Seed) for an M2M device group	Shall be present when an M2M device is registered for M2M multicast service of the M2M device group and multicast SA for the associated multicast service is supported
}			
If (PKM v3 message code == 11) {			
MGID	15	Multicast group identifier	Shall be present when an M2M device is registered for M2M multicast service of the M2M device group and multicast SA for the associated multicast service is supported
MGSS	64	MGSS of the currently used MGTEK	Shall be present when an M2M device is registered for M2M multicast service of the M2M device group and multicast SA for the associated multicast service is supported

Table 6-72—AAI-PKM-RSP message field description *(continued)*

Field	Size (bits)	Value/Description	Condition
M2MGTEK-COUNT	16	The index of the currently used MGTEK	Shall be present when an M2M device is registered for M2M multicast service of the M2M device group and multicast SA for the associated multicast service is supported
}			

Change Table 6-73 as indicated:

Table 6-73—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
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 predefined 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), the ABS shall assign a different BR index to service flows whose UL Grant Scheduling Type is different and shall assign a 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 the 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. If BR action is 0b11, the Purpose Indication bits shall be followed to indicate the activity of the M2M device.

Insert the following text at the end of subclause 6.2.3.47.1:

M2M devices should set bit 4 to 1 in the Idle Mode Retain Information element in the AAI-DREG-REQ message.

Change Table 6-85 as indicated:

Table 6-85—AAI-DSA-REQ message field description

Field	Size (bits)	Value/Description	Condition
...			
For (i = 1; $i \leq$ N-Predefined-BR-indices; i++) {		The mapping of a predefined BR index used in a quick access message to BR size and BR actions N-Predefined-BR-indices is the number of predefined BR indices [1..15]	
Predefined BR index	4	Predefined BR index	Present if N-Predefined-BR-indices is not zero
BR action	2	0b00: ertPS service flow requests to resume to maximum sustained rate 0b01: aGP service flow requests to switch to Primary QoS parameters 0b10: BR 0b11: ~~*Reserved*~~Abnormal Power Down Indication	Present if N-Predefined-BR-indices is not zero
...			
}			
...			
Minimal Access Window Size	10	The minimal size of a window within which the M2M device shall select the start time for the network entry procedure in units of 1 second.	Shall be present if this message is sent by the ABS to assign an Access Window to control initial ranging for an uplink service flow related with M2M
If (Multicast service flow for M2M device){			

Table 6-85—AAI-DSA-REQ message field description *(continued)*

Field	Size (bits)	Value/Description	Condition
SFID	32	Service flow identifier	Shall be present if this service flow is related with M2M multicast service and when an ABS initiates AAI-DSA-REQ.
MGID	12	MGID to be added	Shall be present if this service flow is related with M2M multicast service and when an ABS initiates AAI-DSA-REQ.
M2M-Group-Zone-Index	2	M2M-Group-Zone-Index of the corresponding M2M-GROUP-ZONE-ID that the MGID belongs to. It is derived based on the implicit ordering of the M2M-GROUP-ZONE-IDs in the AAI-SCD message transmitted by the ABS.	Shall be present if the ABS is part of more than one M2M Group Zone.
MGSS	64	MGSS (M2M service Group Security Seed) for an M2M device group	Shall be present when an ABS initiates AAI-DSA-REQ for this service flow that is related with M2M multicast service and multicast SA for the associated service flow is supported.
}			

6.2.3.47.2 AAI-DSA-RSP

Change Table 6-86 as indicated:

Table 6-86—AAI-DSA-RSP message field description

Field	Size (bits)	Value/Description	Condition
...	...	...	...
Minimal Access Window Size	10	The minimal size of a window within which the M2M device shall select the start time for the network entry procedure in units of 1 second.	Shall be present if this message is sent by the ABS to assign an Access Window to control initial ranging for an uplink service flow related with M2M
If (Multicast service flow for M2M device)			
{			

Table 6-86—AAI-DSA-RSP message field description *(continued)*

Field	Size (bits)	Value/Description	Condition
MGID	12	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.
M2M-Group-Zone-Index	2	M2M-Group-Zone-Index of the corresponding M2M-GROUP-ZONE-ID that the MGID belongs to. It is derived based on the implicit ordering of the M2M-GROUP-ZONE-IDs in the AAI-SCD message transmitted by the ABS.	Shall be present if the ABS is part of more than one M2M Group Zone.
}			

6.2.3.47.4 AAI-DSC-REQ

Change Table 6-88 as indicated:

Table 6-88—AAI-DSC-REQ message field description

Field	Size (bits)	Value/Description	Condition
...	...	...	...
MGID	12	MGID to be changed to.	Shall be included by an ABS if MGID needs to be changed (see 6.2.1.3.1)
M2M-Group-Zone-Index	2	M2M-Group-Zone-Index of the corresponding M2M-GROUP-ZONE-ID that the MGID belongs to. It is derived based on the implicit ordering of the M2M-GROUP-ZONE-IDs in the AAI-SCD message transmitted by the ABS.	Shall be present if the ABS is part of more than one M2M Group Zone.
Minimal Access Window Size	10	The minimal size of a window within which the M2M device shall select the start time for the network entry procedure in units of 1 second.	Shall be present if this message is sent by the ABS to assign an Access Window to control initial ranging for an uplink service flow related with M2M

6.2.3.47.5 AAI-DSC-RSP

Change Table 6-89 as indicated:

Table 6-89—AAI-DSC-RSP message field description

Field	Size (bits)	Value/Description	Condition
...	...	...	...
Minimal Access Window Size	10	The minimal size of a window within which the M2M device shall select the start time for the network entry procedure in units of 1 second.	Shall be present if this message is sent by the ABS to assign an Access Window to control initial ranging for an uplink service flow related with M2M

Insert new subclause 6.2.3.64:

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

The ABS shall send the AAI-MTE-IND message to M2M devices to indicate the end of multicast transmission by using either broadcast manner or multicast manner. In the case of broadcast manner, the PHY burst carrying the AAI-MTE-IND message shall be sent by the Broadcast Assignment A-MAP IE with function index = 0b11 and 16-bit CRC masked with masking prefix = 0b0, message type indicator = 0b010, and masking code = 4094. If the Multicast SA is established for the group of these M2M devices, then the AAI-MTE-IND shall be encrypted using the established Multicast SA (see 6.2.5.5 for details on the encryption method). The PHY burst with the MAC PDU carrying the AAI-MTE-IND message is indicated by the M2M Multicast Assignment A-MAP IE, and the FID in the MAC PDU carrying the unencrypted or encrypted AAI-MTE-IND message is set to zero or one, respectively. In case the AAI-MTE-IND message is encrypted, the multicast SA corresponding to the M2M device group identified by the MGID in M2M Multicast Assignment A-MAP IE is used to decrypt the AAI-MTE-IND message. 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 6-108a—AAI-MTE-IND message field description

Field	Size (bits)	Value/Description	Condition
For (i = 0; i < Num-MGID; i++) {		Number of multicast service flows for which data transmission is stopped [1..4]	
MGID	12	MGID related to the terminated multicast traffic	
M2M-Group-Zone-Index	2	M2M-Group-Zone-Index of the corresponding M2M-GROUP-ZONE-ID that the MGID belongs to	
}			

Insert new subclause 6.2.3.65:

6.2.3.65 AAI-MGMC (M2M device group MAC control) message

The AAI-MGMC message may be sent to a group of M2M devices that belong to the same M2M device group (defined by a MGID) to indicate parameters and/or instructions. The ABS may send the AAI-MGMC message to M2M devices in the Connected State by using either broadcast manner or multicast manner. In the case of broadcast manner, the PHY burst carrying the AAI-MGMC message shall be sent by the Broadcast Assignment A-MAP IE with function index = 0b11 and 16-bit CRC masked with masking prefix = 0b0, message type indicator = 0b010, and masking code = 4094. If the AAI-MGMC message carries control information for one M2M device group and Multicast SA is established for that M2M device group, then the AAI-MGMC message shall be encrypted using the established Multicast SA (see 6.2.5.5 for details on the encryption method). The PHY burst with the MAC PDU carrying the AAI-MGMC message intended for one M2M device group is indicated by the M2M Multicast Assignment A-MAP IE, and the FID in the MAC PDU carrying the unencrypted or encrypted AAI-MGMC message is set to zero or one, respectively. In case the AAI-MGMC message is encrypted, the multicast SA corresponding to the M2M device group identified by the MGID in M2M Multicast Assignment A-MAP IE is used to decrypt the AAI-MGMC message.

Table 6-108b—AAI-MGMC message field description

Field	Size (bits)	Value/Description	Condition
Action Code	2	Use to identify the purpose if this message 0b00: Re-assignment of MGID value 0b01–0b11: *Reserved*	
If (Action Code == 0x00) {			
for (i = 1; $i \leq$ Num-MGID; i++) {		Number of MGID to be updated [1..4]	
Current-MGID	12	Current MGID value	
New-MGID	12	New MGID value to be assigned	
M2M-Group-Zone-Index	2	M2M-Group-Zone-Index of the corresponding M2M-GROUP-ZONE-ID to which the MGID belongs	
}			
}			

6.2.5 AAI Security

6.2.5.2.1.2 Key hierarchy

Change Figure 6-18 as indicated:

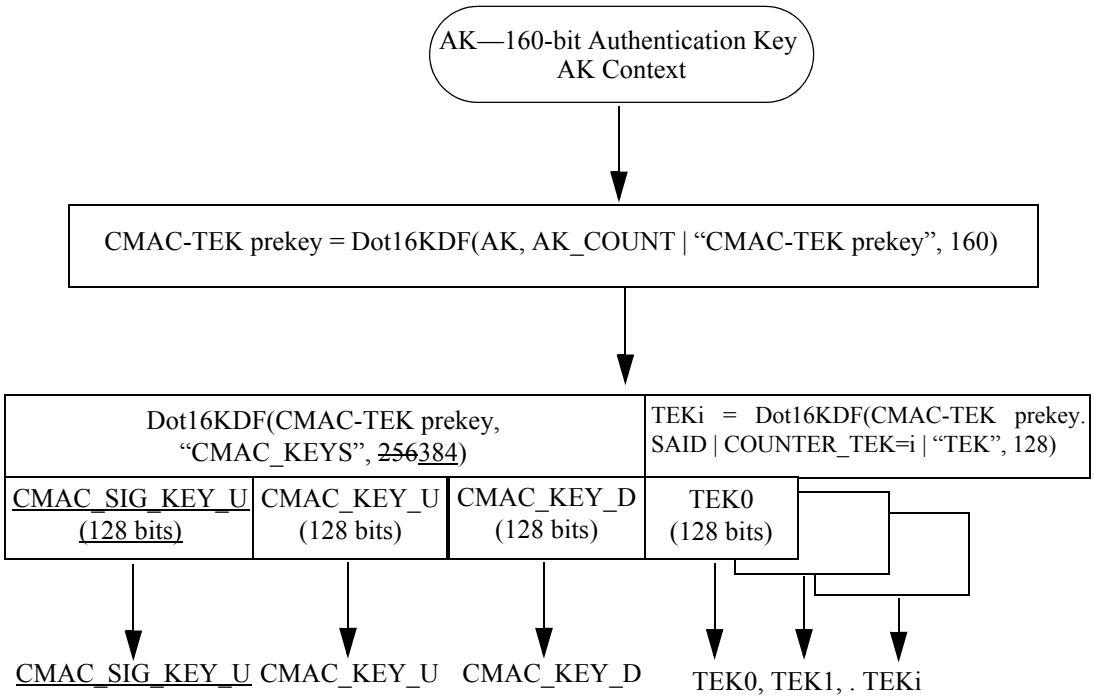

Figure 6-18—CMAC key and TEK derivation from AK

6.2.5.2.2 SA Management

Change Table 6-109 as indicated:

Table 6-109—SA mapping with protection level

SAID	Name of SA	Characteristics	Usage
0x00	Null SA	Neither confidentiality nor integrity protection	For nonprotected transport flow.
0x01	Primary SA	Confidentiality and integrity protection(i.e., AES-CCM mode is applied)	Encryption for unicast control/transport flow.
0x02		Confidentiality protection only (i.e., AES-CTR mode is applied)	Encryption for unicast transport flow
0x03	Multicast SA	Confidentiality protection only (i.e., AES-CTR mode is applied using MGTEK)	Encryption for multicast transport flow of an M2M group
~~0x03~~0x04–0xFF		*Reserved*	

6.2.5.2.2.1 Mapping of flows to SAs

Change the paragraph as indicated:

The following rules for mapping flows to SAs apply:

a) The unicast transport flows shall be mapped to an SA.

b) The multicast or broadcast transport flows shall be mapped to Null SA.

c) The encrypted unicast control flows shall be mapped to the Primary SA.

d) The nonencrypted unicast control flows shall not be mapped to any SA.

e) The broadcast control flows shall not be mapped to any SA.

f) The multicast transport flow for an M2M group shall be mapped to Null SA or Multicast SA.

g) The encrypted multicast control flow shall be dynamically mapped to different Multicast SA. The encrypted multicast control flow carrying the control message for an M2M device group shall be mapped to the Multicast SA established for that M2M device group.

Change subclause 6.2.5.2.3.1 as indicated:

6.2.5.2.3.1 Payload encryption methods

AES-CCM [refer to NIST Special Publication 800-38C and FIPS 197 Advanced Encryption Standard (AES)] shall be used as an encryption method when PDUs on the unicast control connection are encrypted. Unicast transport connections may be encrypted with AES-CTR (refer to NIST Special Publication 800-38A) or AES-CCM.

An M2M short data burst in AAI-RNG-REQ may be encrypted with the method defined in 6.2.5.2.3.1.3.

Insert new subclause 6.2.5.2.3.1.3 as indicated:

6.2.5.2.3.1.3 M2M short data burst encryption method

The plaintext M2M short data burst shall be encrypted using an AES-CTR method.

The TEK for the M2M short data burst is derived as follows:

TEK = Dot16KDF (CMAC-TEK prekey, SAID | COUNTER_TEK | “TEK”, 128)

where

— CMAC-TEK prekey is derived from AK that is derived from PMK.

— SAID and COUNTER_TEK are predefined values for the M2M short data burst, for example, SAID is set to 0x02 and COUNTER_TEK is set to 0.

The Nonce N construction applied to AES-CTR block is shown in Table 6-112a.

The first 2 bytes shall be filled with the length of an M2M short data burst. If the STID and the FID have not been assigned, then the corresponding fields shall be set to all zeros. The EKS shall set to 0b00, and the PN shall be the same value as CMAC_PN_U to be sent with the AAI-RNG-REQ message.

Table 6-112a—Nonce N construction

Byte number	0 1	2 3	4 9	10 12
Field	M2M short data burst length	STID and Flow ID	*Reserved*	EKS and Packet Number
Contents	M2M short data burst length	STID | FID	0x000000000000	00 | CMAC_PN_U

The *i*-th counter block Ctr_i is shown in Figure 6-22a.

Byte number	0	1 13	14 15
Byte significance			MSB LSB
Number of bytes	1	13	2
Field	Flag	Nonce	Counter
Contents	0x1	As specified in Table 6-112a	i

Figure 6-22a—Construction of counter block Ctr_i

The AAI-RNG-REQ message with a ciphered M2M short data burst is shown in Figure 6-22b.

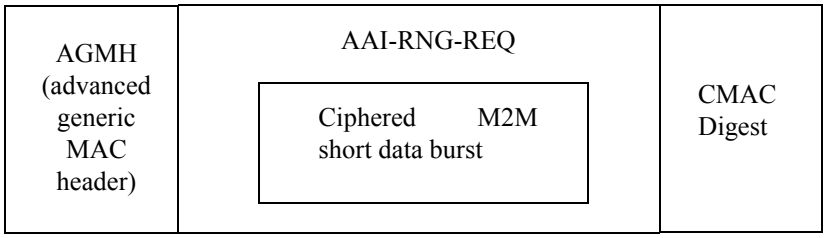

Figure 6-22b—AAI-RNG-REQ message with ciphered M2M short data burst

Unlike MAC PDU encryption, the ciphered M2M short data burst is carried in the AAI-RNG-REQ message. Because the ciphered M2M short data burst is not prepended with a 2-bit EKS and a 22-bit PN (Packet Number) and is not appended with an ICV, the ciphered M2M short data burst has the same size as its plaintext. The M2M short data burst is protected by the AES-CTR method, which does not include additional overhead, as well as by CMAC validation of the AAI-RNG-REQ message.

Insert 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.

Insert new subclause 6.2.5.5.1 as indicated:

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 the M2M device group.

Insert new subclause 6.2.5.5.1.1 as indicated:

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 IEEE Std 802.16. MGTEK is also used to encrypt the MAC control message transmitted to a group of M2M devices.

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

The MGTEK derivation is done:

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

where

- MAK is the M2M service Authorization Key that is provided to all authorized M2M devices.
- MGSS is the M2M service Group Security Seed that is common for an M2M device group.
- M2MGTEK-COUNT is the index of the currently used MGTEK.
- MGID is the identifier of the group, which the M2M device and MAK and MGSS is associated with.

Insert new subclause 6.2.5.5.2 as indicated:

6.2.5.5.2 Key hierarchy

Figure 6-27a outlines the process to calculate the MGTEK based on a MAK, an M2MGTEK-COUNT, and an MGSS provided by the ABS.

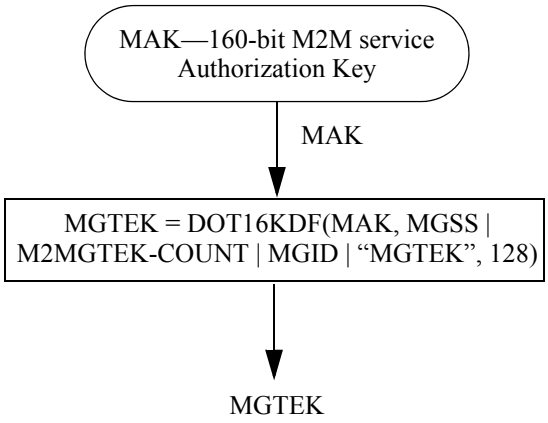

Figure 6-27a—MGTEK derivation from MAK

Insert new subclause 6.2.5.5.3 as indicated:

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 M2M device. MGTEK is also used for encrypting DL MAC control message transmitted by the ABS to a group of M2M devices, which is also used for decrypting such a DL MAC control message by the M2M devices.

Insert new subclause 6.2.5.5.3.1 as indicated:

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 device 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 M2M devices in the M2M device group through the AAI-PKM-RSP message. The M2MGTEK-COUNT is initialized. A new MGTEK is generated with the new MGSS and the M2MGTEK-COUNT.

When the MGID update is triggered and a new MGID is provided to M2M devices in the M2M device group (see 6.2.1.3.1 for MGID update triggers and method to assign new MGID), the M2MGTEK-COUNT is initialized. A new MGTEK is generated with the new MGID and the M2MGTEK-COUNT.

The M2M device may request current M2MGTEK parameters by transmitting an AAI-PKM-REQ message to the ABS. Here, the M2M device 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.

Insert new subclause 6.2.5.5.3.2 as indicated:

6.2.5.5.3.2 Key update during location update

When a new MGSS is derived, an M2M device 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 M2M device is to update the MGTEK, the ABS sends the new MGSS in the AAI-PKM-RSP message.

Insert new subclause 6.2.5.5.4 as indicated:

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 0x0000000 (from 0x3FFFFF), it is incremented by 1 mod 8. The 5 least significant bits of ROC shall be allocated to M2M multicast MAC PDUs in such a 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 $2^3 \times 2^{24} = 2^{27}$ 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 M2M device and the ABS shall ensure that an 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 6-119a.

Table 6-119a—Construction of 32-bit nonce

Byte number	0	1 2 3
Field	ROC	Superframe number
Contents	ROC	22-bit superframe number | 2-bit Frame index

A 32-bit nonce NONCE = n0 | n1 | n2 | n3 is made of ROC and 12-bit superframe number and 2-bit frame index (see Table 6-119a). 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 6-27b.

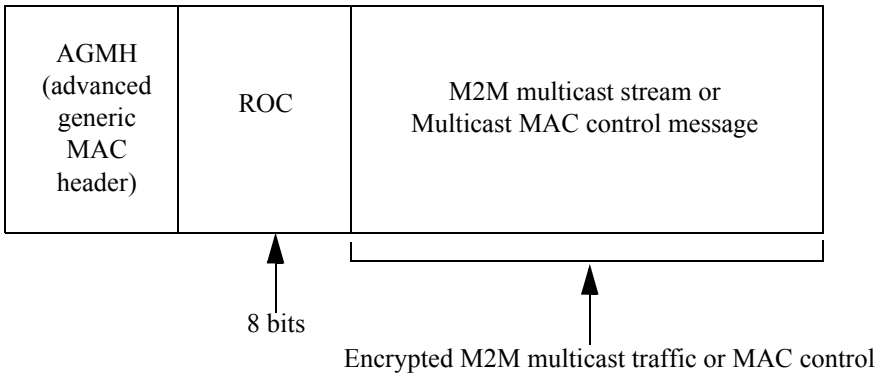

Figure 6-27b—M2M multicast MAC PDU ciphertext payload format

Insert new subclause 6.2.5.6 as indicated:

6.2.5.6 M2M device validity check

An M2M device that has device validity checking implemented and has failed its validity test shall refrain from accessing the network. During the PKM exchange, an EAP based authentication procedure (IETF RFC 3748) may be used to carry a device validity certificate to the network.

Insert new subclause 6.2.5.7 as indicated:

6.2.5.7 Abnormal power down signaling header protection using Cipher-based message Authentication Code (CMAC)

An M2M device may support abnormal power down signaling header integrity protection based on CMAC-together with the AES block cipher. The CMAC construction as specified in NIST Special Publication 800-38B shall be used. The calculation of the keyed hash value contained in the CMAC Digest attribute and the CMAC Tuple shall use the CMAC algorithm with AES. The UL authentication key CMAC_SIG_KEY_U shall be used for authenticating an abnormal power down signaling header transmitted by M2M device in the UL direction. The CMAC_SIG_KEY_U is derived as follows:

CMAC_SIG_KEY_U = Dot16KDF (CMAC-TEK prekey, “CMACSIG”, 128)

The 8-bit ROC is the rollover counter for the frame number; i.e., when the frame number reaches 0x0000000 (from 0xFFFFFF), it is incremented by $1 \bmod 2^8$. ROC shall be reset to zero upon obtaining a new CMAC-TEK prekey. Using this method, one abnormal power down signaling header per frame using the same CMAC_SIG_KEY_U can be supported. A new encryption key (CMAC_SIG_KEY_U) is required every $2^{24} \times 2^8 = 2^{32}$ frames. The reauthorization process should be initiated to establish a new PMK/AK before the ROC reaches the end of its number space.

The CMAC value shall be calculated over a field consisting of the AK ID followed by the superframe number and frame index expressed as an unsigned 24-bit number, followed by the 12-bit STID and 4-bit FID (FID of signaling header), followed by 8-bit ROC, followed by 16-bit of zero padding (for the header to be aligned with AES block size) and followed by the contents of abnormal power down signaling header other than CMAC. The CMAC value for abnormal power down signaling header shall be calculated as follows:

CMAC value = Truncate(CMAC (CMAC_SIG_KEY_U, AK ID | 22-bit superframe number| 2-bit frame index |STID|FID|ROC|16-bit zero padding |Abnormal power down signaling header contents other than CMAC & ROC), 16)

The LSB 16-bit of the outcome of AES-CMAC calculation shall be used for the CMAC value.

6.2.7 Persistent scheduling in the Advanced Air Interface

Insert the following text at the end of 6.2.7:

Long-cycle persistent allocation is used for high-priority M2M connections with periodic traffic pattern and relatively fixed payload size. To allocate resources persistently to a fixed M2M device, the ABS may transmit the UL M2M Persistent Allocation MAP IE for UL allocations with a longer allocation period.

6.2.7.1 Allocation mechanism

Insert the following text at the end of 6.2.7.1:

The UL resource assigned by long-cycle persistent scheduling may be changed temporally. To change a UL persistent assignment temporally, the ABS shall transmit the UL M2M Persistent Allocation A-MAP IE with Allocation Period set to 0b1111. If an M2M device has an existing persistent allocation in a particular AAI subframe and receives a new resource allocation in the same AAI subframe by receiving the UL M2M Persistent Allocation A-MAP IE with Allocation Period set to 0b1111, the new resource allocation shall replace the original persistent allocation only at the AAI subframe (i.e., the original persistent allocation is resumed from the next allocation period).

6.2.7.2 Deallocation mechanism

Insert the following text at the end of 6.2.7.2:

In case of de-allocation of long cycle persistent scheduling by UL M2M persistent allocation A-MAP IE, if de-allocation type is set to 0b0 (i.e., Permanent de-allocation), the persistent resource assigned by the UL M2M persistent allocation A-MAP IE shall be de-allocated in the reference UL subframe and the ABS and M2M device shall terminate the persistent allocation. Otherwise (i.e., One-time de-allocation), the persistent resource assigned by the UL M2M persistent allocation A-MAP IE shall be de-allocated in the reference UL subframe once and the ABS and M2M device shall retain the previous persistent allocation.

6.2.7.4 Error handling procedure

Insert the following text at the end of 6.2.7.4:

In the case of one-time de-allocation (i.e., de-allocation type = 0b1) in UL M2M Persistent allocation A-MAP IE, the ABS shall not transmit a HARQ feedback allocation (HFA) in the UL M2M Persistent Allocation A-MAP IE.

6.2.14 HARQ functions

6.2.14.2.1.2 Uplink

Insert the following text at the end of 6.2.14.2.1.2:

When an ABS allocates a 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 a different ACID from the ACID of the retransmitted UL burst.

6.2.15 Network entry and initialization

6.2.15.3 Initial ranging and automatic adjustments

Change subclause 6.2.15.3 as indicated:

After DL synchronization, the AMS shall attempt to perform initial ranging with the ABS. If the ranging procedure is successfully completed, the AMS is UL synchronized with the ABS and obtains TSTID from the ABS. The TSTID is used until the ABS assigns the AMS an STID through the registration procedure.

When an M2M device attempts to enter or reenter the network and

- the network entry or reentry is not in response to paging (e.g., it may be triggered by an event), and
- the uplink service flow that the M2M device will use to transmit data upon network entry completion is associated with a Minimal Access Window Size,

then the M2M device shall apply a uniform random process to select the start time of the network entry procedure from a window whose size is greater than or equal to the Minimum Access Window Size.

The Minimum Access Window Size does not apply to the abnormal power down procedure; see 6.2.29.

Insert new subclause 6.2.15.7 as indicated:

6.2.15.7 Access class of M2M devices

The ABS may restrict the usage of a nondedicated ranging channel by M2M devices, by setting the access class to 1 in the AAI-SCD message. The 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 the AAI-SCD message may be used for configuring 4 access classes, and every access classes can span 4 continuous superframes based on NS-RCH configuration. An access class relative ID of superframe R is expressed as follows:

R = mod(superframe number, N)

$N = M \times W$ is the total number of superframes that all of the access class includes and is set for 16, M is the total number of access class and is set to 4, and W is the number of superframes in one access class and is set to 4.

Allocation of access class can refer to Table 6-140a. The ABS can decide which access class that the M2M devices can use for ranging during network reentry.

Table 6-140a—Allocation of access class

Field	Condition
Access class (i)	$0 \le R \le 3$
Access class ($i + 1$)	$4 \le R \le 7$
Access class ($i + 2$)	$8 \le R \le 11$
Access class ($i + 3$)	$12 \le R \le 15$

Table 6-140b—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

Insert following text at the end of 6.2.16 as indicated:

For fixed M2M devices, periodic ranging may be omitted.

6.2.18 Idle mode

Insert new subclause 6.2.18.7 as indicated:

6.2.18.7 Idle mode for M2M application

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

An 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 an M2M device-specific Idle Mode Timer. When the M2M device receives the AAI-DREG-RSP message with an M2M device-specific Idle Mode Timer, the M2M device shall perform a 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.

Insert new subclause 6.2.18.7.1 as indicated:

6.2.18.7.1 Paging operation

Group paging may be used for M2M devices. For this, the M2M Group Identifier (MGID) defined in 6.2.1.3.1 along with the M2M-Group-Zone-Index of the associated M2M Group Zone may be included in a paging message instead of an individual identifier to identify the group of M2M devices. The M2M device follows the paging cycle as per 6.2.18 for monitoring both individual and group paging.

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

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 the 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 the AAI-DREG-RSP message.

If the M2M device receives the AAI-PAG-ADV message with an M2M extension flag set to 1, the M2M device shall remain awake and monitor the subsequent AAI subframe unless its identifier is found in the received segments. Otherwise, the M2M device returns to the paging unavailable interval.

Insert new subclause 6.2.18.7.2 as indicated:

6.2.18.7.2 Network reentry from idle mode for M2M devices

An ABS 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 the ABS 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 the ABS does not assign dedicated ranging resources, M2M devices perform ranging for network (re-)entry using the ranging resources defined in Table 6-184 in 6.3.5.5.1.2. The configuration of ranging assignment for M2M devices is indicated through the M2M ranging indicator in the AAI-SCD message.

During paging, an ABS may assign a different network access type to each individual M2M device or each M2M group by including an M2M network access type parameter in the AAI-PAG-ADV message. If the M2M network access type is set to 0b00, the M2M device does not need to send the CDMA code for ranging but sends the AAI-RNG-REQ message using the resource allocation information indicated in the AAI-PAG-ADV message.

When the M2M device receives the group paging message (i.e., AAI-PAG-ADV with MGID and M2M-Group-Zone-Index) and the M2M network access type is set to 0b00 (i.e., Resource allocation for AAI-RNG-REQ), it shall monitor the Fixed M2M Ranging Assignment A-MAP IE to obtain the resource for the AAI-RNG-REQ message at 'Assignment A-MAP start offset for AAI-RNG-REQ' during the 'Resource monitor timer'. If the M2M device does not decode the Fixed M2M Ranging Assignment A-MAP IE until the expiration of the 'Resource monitor timer', it performs contention-based ranging.

If the M2M device receives the group paging message (i.e., AAI-PAG-ADV with MGID and M2M-Group-Zone-Index) and the M2M network access type is set to 0b01, the ABS shall allocate the dedicated ranging channel (i.e., M2M ranging opportunity subframe index and Periodicity of the M2M ranging) for M2M devices in the AAI-PAG-ADV message, and the dedicated S-RCH allocation is used for ranging.

If the M2M device receives the group paging message (i.e., AAI-PAG-ADV with MGID and M2M-Group-Zone-Index) and the M2M network access type is set to 0b10, the ABS shall allocate the dedicated ranging channel (i.e., M2M ranging opportunity subframe index and Periodicity of the M2M ranging) for M2M devices in AAI-PAG-ADV message, and the dedicated NS-RCH allocation is used for ranging.

If the M2M device receives the group paging message (i.e., AAI-PAG-ADV with MGID and M2M-Group-Zone-Index) and the M2M network access type is set to 0b11, the M2M device performs the normal ranging using the ranging resources defined in Table 6-184 in 6.3.5.5.1.2.

When the M2M device receives the individual paging message (i.e., AAI-PAG-ADV with DID or FMDID) and the M2M network access type is 0b00 (i.e., Resource allocation for AAI-RNG-REQ), it decodes the Fixed M2M Ranging Assignment A-MAP IE to obtain the resource of the AAI-RNG-REQ message at 'Assignment A-MAP offset for AAI-RNG-REQ'.

When the M2M device receives the individual paging message (i.e., AAI-PAG-ADV with DID or FMDID) and the M2M network access type is set to 0b01 (i.e., dedicated ranging channel allocation in AAI-PAG-ADV), the ABS shall allocate the dedicated ranging channel (i.e., M2M ranging opportunity subframe index and Periodicity of the M2M ranging) for M2M devices in the AAI-PAG-ADV message and information of the dedicated ranging channel is included in the AAI-PAG-ADV message.

When the M2M device receives the individual paging message (i.e., AAI-PAG-ADV with DID or FMDID) and the M2M network access type is set to 0b10 (i.e., dedicated ranging channel allocation in broadcast assignment A-MAP IE), the ABS shall allocate the dedicated ranging channel (i.e., M2M ranging opportunity subframe index and Periodicity of the M2M ranging) for M2M devices in the AAI-PAG-ADV message and information of the dedicated ranging channel is included in the Broadcast Assignment A-MAP IE.

The ABS may indicate the dedicated ranging channel (i.e., M2M ranging opportunity subframe index and Periodicity of the M2M ranging) as indicated by the AAI-SCD message in the AAI-PAG-ADV message as well.

If the dedicated ranging channel (i.e., M2M ranging opportunity subframe index and Periodicity of the M2M ranging) that is allocated through the AAI-PAG-ADV message is different with the dedicated ranging channel that is allocated via the AAI-SCD message, the Dedicated Channel Allocation Timer is included in the AAI-PAG-ADV message and the allocated dedicated ranging channel is valid within the Dedicated Channel Allocation Timer.

If the M2M device receives the individual paging message (i.e., AAI-PAG-ADV with DID or FMDID) and the M2M network access type is set to 0b11, the M2M device performs the normal ranging using the ranging resources defined in Table 6-184 in 6.3.5.5.1.2.

During paging, an ABS may assign an Initial ranging backoff start to M2M devices by the AAI-PAG-ADV message. The Initial ranging backoff start included in the AAI-PAG-ADV message shall be different from the one assigned by SFH SP3. If M2M devices receive the AAI-PAG-ADV message that includes Initial ranging backoff start, they shall use the Initial ranging backoff start included in the AAI-PAG-ADV message to determine the initial backoff window size for initial ranging during network reentry or location update. This Initial ranging backoff start shall be only applied to the ranging process that is in response to the AAI-PAG-ADV message. The ranging backoff mechanism supported to each M2M device shall be negotiated through the AAI-REG-REQ/RSP message.

When the M2M devices restart the ranging procedure and the ranging backoff window indicator in the AAI-PAG-ADV message is set to 0b1, and the M2M devices support the ranging backoff mechanism associated with a ranging backoff window indicator of 0b1, they shall determine the ranging opportunities within

following backoff window size: Backoff window size(K_x) = The initial backoff window size(K_0)/2^x, where x is the number of ranging retransmissions and the minimum K_x is set to equal or more than 2.

The M2M devices shall determine the start point of the backoff window as the following equation:

Since receiving the AAI-PAG-ADV message, the x^{th} backoff window per each M2M device starts after $\max\left(\sum_{i=0}^{i=x-1} K_i, (x-1)^{th} opportunity + Delay_{T31}\right)$, where $Delay_{T31}$ is the processing delay term as T31. The unit depends on the ranging configuration as described in 6.3.5.5.1.2.

During network reentry, the M2M device may request a UL BW grant without a contention-based bandwidth request by including Bandwidth Request Size in an AAI-RNG-REQ message. If an ABS receives the AAI-RNG-REQ message with Bandwidth Request Size, the ABS may allocate a UL bandwidth based on the Bandwidth Request Size if the ABS possesses the M2M device information, without a contention-based bandwidth request from the M2M device by setting the bandwidth grant indicator in an AAI-RNG-RSP message. If the bandwidth indicator is enabled, the ABS should allocate UL bandwidth within the BR grant time duration 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 a contention-based bandwidth request.

The BR grant timer in the 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 the 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.

If the fixed M2M device receives the group paging message (i.e., AAI-PAG-ADV with MGID) and the M2M network access type is set to 0b01 or 0b10, the M2M device may decide if it will do the network reentry in the dedicated ranging channel by comparing a generated random number ~ U(0,1) with the parameter “Group Access Probability”; if the generated random number is bigger than the “Group Access Probability”, the M2M device will do the network reentry. Group Paging Change Count is used for indicating if there is a new round of group paging for one M2M group. If it is a new round of group paging for one M2M group, all group member can do the network reentry if needed.

Insert new subclause 6.2.18.7.3 as indicated:

6.2.18.7.3 Idle mode optimizations for fixed M2M devices

A fixed M2M device in idle mode does not need to perform the paging operation and location update operation based on the paging group. To eliminate the need for allocating the unnecessary paging information (i.e., Paging Group ID and Paging Controller ID), a fixed M2M device may enter localized idle mode. The localized idle mode entry procedure is the same as the idle mode entry procedure as defined in 6.2.18.1.

The localized idle mode for the fixed M2M device is initiated either by the fixed M2M device or by its S-ABS.

In case of M2M device-initiated localized idle mode entry, a fixed M2M device may include Localized-Idle-Mode-flag set to 1 in the AAI-DREG-REQ message. The fixed M2M device may request the ABS to retain

specific M2M device service and operational information for idle mode management purposes through inclusion of the Idle Mode Retain information element in the AAI-DREG-REQ message.

When an ABS receives an AAI-DREG-REQ with Localized-Idle-Mode-flag set to 1 and accepts M2M device's request, it does not inform the Paging Controller that the M2M device enters idle mode.

Then the ABS sends AAI-DREG-RSP with Localized-Idle-Mode-flag set to 1 or 0. Localized-Idle-Mode-flag set to 1 indicates that the ABS accepted the M2M device's request. Then the M2M device transitions to localized idle mode and does not perform the paging operation and location update operation based on the paging group.

If Localized-Idle-Mode-flag included in the AAI-DREG-RSP is set to 0, the M2M device enters the normal idle mode.

Using ABS-initiated localized idle mode entry, an ABS may signal for a fixed M2M device to begin localized idle mode by sending an AAI-DREG-RSP message in unsolicited manner. This unsolicited AAI-DREG-RSP may include Localized-Idle-Mode-flag set to 1. When a fixed M2M device receives an unsolicited AAI-DREG-RSP with Localized-Idle-Mode-flag set to 1, the fixed M2M device shall immediately start the idle mode initiation procedures by sending the AAI-DREG-REQ message with Localized-Idle-Mode-flag set to 1 or 0 in response to the unsolicited AAI-DREG-RSP message.

Insert new subclause 6.2.18.7.3.1 as indicated:

6.2.18.7.3.1 Idle mode operations for fixed M2M devices

When the fixed M2M device enters the localized idle mode, a Fixed M2M Deregistration ID (FMDID) is assigned to the fixed M2M device, and the Paging Controller ID, Paging Group ID, and Deregistration ID are 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.

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

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

For a fixed M2M device, a fixed M2M device de-registration identifier (FMDID) may be included in a paging message instead of DID to identify the fixed M2M device in localized idle mode. The M2M device with FMDID shall monitor a predetermined frame for paging message. The predetermined frame $N_{paging\ frame}$ for the fixed M2M device is implicitly determined as follows:

$N_{paging\ frame}$ = Fixed M2M de-registration ID (FMDID) mod *m*

where

m = 1 or 2 or 3 or 4

m is indicated by an ABS using the PGID-Info message.

Insert new subclause 6.2.18.7.4 as indicated:

6.2.18.7.4 Network reentry from idle mode for M2M device group

In order to reduce the network congestion produced by a large number of M2M devices, network reentry may be initiated as a group of M2M devices. M2M devices in an M2M device group are called a group member (GM). An M2M device in a group that is authorized to act as a representative for this M2M device group is called as a group delegate (GD). A GD initiates the first ranging access for this M2M device group. An ABS assigns a dedicated ranging code to a GD. When M2M devices in an M2M device group are expected to transmit UL data, the group delegate selects a ranging code from a ranging code set based on the M2M device Group ID (MGID) and transmits the selected ranging code to an ABS. On receiving this ranging code, the ABS sends the AAI-RNG-ACK message in response, which includes one of three ranging status (success, abort, and continue) for the group. All group members shall receive a ranging status response to the dedicated ranging code transmitted by the GD in the AAI-RNG-ACK message. There are three possible ranging status responses from the ABS provided in the AAI-RNG-ACK message. They are as follows:

— If ranging status is “success”, all GMs in this group start its network reentry procedure by transmitting a ranging code. The GMs may select a ranging code from a legacy ranging code set or a new ranging code set dedicated for M2M devices. The GMs may also select a ranging channel from legacy ranging channels or new ranging channels dedicated for M2M devices. Before transmitting the ranging code, the GM shall randomly select a backoff value within the initial backoff window for network access.

— If ranging status is “abort”, all GMs in this group shall start the ranging abort timer and abort the ranging process until the ranging abort timer expires. After the abort timer expires, all M2M devices in this group shall restart the ranging process as done on the first entry defined in this subclause.

— If ranging status is “continue”, the GD in this group shall adjust its parameters accordingly and continue the ranging process.

Upon a detection of an event specific for a group (i.e., MGID), the GMs of this group shall start the T32 timer defined in 6.11. Within the T32 timer, the GMs of this group await the AAI-RNG-ACK message transmitted by the ABS in response to the ranging code sent by this group’s GD. If GMs receive the AAI-RNG-ACK message, every GM initiates further action for network reentry. If GMs do not receive the AAI-RNG-ACK message within the duration of T32, the GMs perform voluntary network reentry upon expiry of the T32 timer. The ABS shall indicate whether the network supports the GD scheme or not, and a detailed indication is included in the AAI-SCD message.

Insert new subclause 6.2.18.7.4.1 as indicated:

6.2.18.7.4.1 Selection of M2M device group delegate

Selection of the M2M group delegate shall be supported by both fixed and mobile devices that support the group delegate function, and the selection rule is described as follows:

When members of an M2M device group need to report UL data, each member of the group should receive the value of a random selection probability θ from the broadcast message AAI-SCD, and every member should compare the value of θ with a self-generated random number m.

If $m \leq \theta$, the device is designated as a group delegate.

If $m > \theta$, the device cannot be designated as a group delegate.

The designated group delegate should choose a certain superframe based on MGID, and then it should send a dedicated ranging code to an ABS in this superframe. If the group delegate receives "continue" or "abort" instruction from the information in the AAI-RNG-ACK message for the dedicated ranging code it has sent for this group, it should continue to act as a group delegate. If the group delegate receives "success" instruction from the information in the AAI-RNG-ACK message for the dedicated ranging code it has sent for this group, it should resign from the position of group delegate and begin to act as an ordinary group member.

If a group member cannot receive any information in the AAI-RNG-ACK message for the dedicated ranging code for this group, the ABS may have failed to detect the dedicated ranging code for this group. In this case, the ABS should increase random selection probability θ, and the selection procedure elaborated above should be repeated.

The value of θ is broadcast by the ABS via the broadcast message (AAI-SCD). The ABS also controls the variety of θ, the value of which remains fixed during the interval between two AAI-SCD messages. The M2M device calculates the random data and probability based on Equation (9a):

$$\text{Yrand} = (\text{Xrand\_seed} \times m + n) \bmod j \tag{9a}$$

Both m and n are integers, and one of these two parameters has to be a prime number; j is the max of Y_{rand} and prime number $2^{16} - 15 = 65521$;

$$P_{selection} = (\text{Yrand})/j$$

Insert new subclause 6.2.18.7.4.2 as indicated:

6.2.18.7.4.2 Ranging channel and ranging code for M2M device group

When an M2M device group is expected to report its data, a group delegate of the group selects a ranging code from the ranging code set based on the M2M device Group ID (MGID) and transmits the selected ranging code to the ABS.

The calculation equation for selection of the dedicated ranging code is as follows:

$$r_{\text{dedicated ranging code}} = \text{mod}(\text{floor}(MGID/M), N_{\text{M2M group}}) \tag{9b}$$

The Zadoff-Chu sequences with cyclic shifts are used for the RP codes. The p^{th} RP code $x_p(k)$ is defined and generated in Equation (291) (see 6.3.8.2.4.1). N_{cont} is the total number of initial ($0 \sim N_{IN} - 1$) and handover RP codes ($N_{IN} \sim N_{IN} + N_{HO} - 1$) per sector for a normal contention-based approach. N_{dedi} is the total number of dedicated handover RP codes. When the dedicated handover RP code set is not allocated, the available additional RP codes set may be used for the M2M device group. $N_{\text{M2M group}}$ is the total number of the available additional RP codes set for the M2M device group ($N_{\text{cont}} + N_{dedi} \sim N_{\text{cont}} + N_{dedi} + N_{\text{M2M group}} - 1$) where the maximum possible $N_{\text{M2M group}}$ per sector is 32.

For a certain M2M device group, there are 4 cases for this:

$$\text{mod}(MGID, M) - \text{mod}(C, M) = 0 \tag{9c}$$

$$M = \left\lfloor MGID_{total} \times \alpha_{\text{multiplexing factor of dedicated ranging code}} / N_{\text{M2M group}} \right\rfloor \tag{9d}$$

M is the required resource of the time domain (ranging channel). $\alpha_{\text{multiplexing factor of dedicated ranging code}}$ can be carried in S-SFH SP3. C is the related superframe number with ranging opportunity. $MGID_{total}$ is the total number of MGIDs.

1) If Configuration of ranging opportunity == 0, $C = 4 \times \text{superframe number} + i$; i is expressed as frame number (0,1,2,3); $N_{\text{ranging opportunity}} = 4$.
2) If Configuration of ranging opportunity == 1, $C = \text{superframe number}$; $N_{\text{ranging opportunity}} = 1$.
3) If Configuration of ranging opportunity == 2, $C = \text{superframe number}/2$; mod (superframe number, 2) == 0; $N_{\text{ranging opportunity}} = 1/2$.
4) If Configuration of ranging opportunity == 3, $C = \text{superframe number}/4$; mod (superframe number, 4) == 0; $N_{\text{ranging opportunity}} = 1/4$.

Insert new subclause 6.2.18.7.5 as indicated:

6.2.18.7.5 S-SFH update in idle mode

When the paging cycle of an M2M device is greater than or equal to $\text{S-SFH change cycle} \times 2^{\text{bit size of S-SFH change count}}$, the M2M device shall decode all the SFH SP IEs before its paging listening interval.

Insert new subclause 6.2.18.7.6 as indicated:

6.2.18.7.6 Location update for M2M devices

Insert new subclause 6.2.18.7.6.1 as indicated:

6.2.18.7.6.1 Location update trigger conditions

An M2M device in idle mode may also perform a location update when it detects that an M2M-GROUP-ZONE-ID of the selected preferred ABS is changed.

Insert new subclause 6.2.18.7.6.1.1 as indicated:

6.2.18.7.6.1.1 M2M Group Zone based update

An M2M device shall perform a location update process when an M2M device detects that the selected preferred ABS does not support its currently assigned M2M-GROUP-ZONE-ID. The M2M device shall detect that by monitoring the M2M-GROUP-ZONE-ID.

6.2.25 Short message service

Insert new subclause 6.2.25.1 as indicated:

6.2.25.1 M2M short data burst transmission

In the Connected State, the AAI-L2-XFER message is used to send/receive an M2M short data burst. In idle mode, an M2M short data burst may be included in the AAI-RNG-REQ/RSP message. The L2-Xfer payload field in the AAI-L2-XFER message and the SMS field in the AAI-RNG-REQ/RSP message are used to contain the M2M short data burst.

In idle mode, this M2M short data burst may be included only when the action code of the AAI-PAG-ADV message indicates a location update or when the AAI-RNG-REQ message with a Ranging Purpose Indication value has 0b0011.

When the UL M2M short data burst is included in an AAI-RNG-REQ message with a Ranging Purpose Indication that has a value 0b0011, an AAI-RNG-RSP message is transmitted as a confirmation of the M2M short data burst.

The encryption of the UL M2M short data burst in the AAI-RNG-REQ message follows the method in 6.2.5.2.3.1.3. When the UL M2M short data burst in the AAI-RNG-REQ message is encrypted, the M2M short data burst encryption indicator in the AAI-RNG-REQ message shall be set to 0b1.

When an AAI-RNG-RSP message includes a DL M2M short data burst, an AAI-MSG-ACK message is sent as a confirmation of the DL M2M short data burst. The ABS grants a CDMA Allocation A-MAP IE for the AAI-MSG-ACK message in an unsolicited manner by an ACK timer, where MCRC is masked with the same RA-ID as in CDMA Allocation A-MAP IE for the AAI-RNG-REQ message. When the M2M device receives the AAI-RNG-RSP message with the DL M2M short data burst, the M2M device starts the ACK timer and waits for the CDMA Allocation A-MAP IE to send the AAI-MSG-ACK message.

6.2.28 Support for multicast service

Insert 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 concurrent transport of DL data common to M2M devices belonging to an M2M device group using an MGID and M2M-Group-Zone-Index 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 the Connected State. During such instantiation, the M2M device learns the parameters that identify the service and associated service flows.

The same MGID is assigned to a group of M2M devices that participate in the same multicast service and is assigned by a network during the 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 = 0b100, and the assigned 12-bit MGID to decode the M2M Multicast Assignment A-MAP IE. If the M2M Multicast Assignment A-MAP IE is decoded successfully, the M2M device shall obtain the multicast burst according to the instruction in the M2M Multicast Assignment A-MAP IE. The FID field in the MAC header of the MAC PDU (in multicast burst) carrying the MAC SDUs for the multicast service flow is set to 0100.

Insert new subclause 6.2.28.4.1 as indicated:

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. The multicast connection shall be established through AAI-DSA MAC control, and a MGID with M2M-Group-Zone-Index is assigned for multicast connection. 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 for multicast traffic as described in 6.2.5.5.

Insert new subclause 6.2.28.4.2 as indicated:

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 procedures are used to change multicast service flows. The AAI-DSD procedure can be used to delete the multicast service flow for an M2M device. In addition, the multicast service flows of an M2M device are deleted when 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. The ABS shall send AAI-DSA-REQ/RSP to the M2M device with the relevant multicast parameters including MGID and M2M-Group-Zone-Index.

Insert new subclause 6.2.28.4.3 as indicated:

6.2.28.4.3 M2M Multicast operation in idle node

An ABS may provide the multicast service for M2M devices in idle mode with or without requiring network reentry of the M2M devices. Before an ABS sends DL multicast data, the ABS shall 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 and the paging message does not include the Multicast transmission start time, 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 ABS. The value of the multicast transmission start time shall be less than the start time of the 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 ABS 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.

Insert new subclause 6.2.29 as indicated:

6.2.29 Abnormal power down reporting

When an abnormal or involuntary power down has occurred, an M2M device tries to report the abnormal power down event.

Insert new subclause 6.2.29.1 as indicated:

6.2.29.1 Abnormal power down reporting in Connected State

If the M2M device is in the Connected State with uplink bandwidth already allocated and available, then it may use the available bandwidth to send an Abnormal Power Down Report signaling header (as defined in 6.2.2.1.3.11).

If the M2M device does not have available UL bandwidth, then it may use the procedure defined in 6.2.11.1.1 to request bandwidth. In the case of using a three-step random access-based BR procedure, the Predefined BR index may be used to indicate that an abnormal or involuntary power down has occurred. In

other cases (e.g., a five-step random access-based BR, piggybacked BR, or BR using P-FBCH), the M2M device may send the Abnormal Power Down Report signaling header upon receiving bandwidth allocation.

After transmitting the Abnormal Power Down Report signaling header or the predefined BR index indicating the abnormal power down event, the M2M device may start its Abnormal Power Down Confirmation timer to wait for the Abnormal Power Down Confirmation signaling header. If the M2M device has not received the Abnormal Power Down Confirmation signaling header until the Abnormal Power Down Confirmation timer expires, it may restart the abnormal power down reporting procedure.

Insert new subclause 6.2.29.2 as indicated:

6.2.29.2 Abnormal power down reporting in idle mode

When an abnormal power down occurs, an M2M device in idle mode that has been configured to report abnormal power down events and that has a valid security association with the preferred ABS shall select a ranging opportunity within a backoff window starting at the next frame. The M2M device shall set the backoff window size as large as possible, yet such that it is guaranteed to complete the abnormal power down reporting procedure before its power is depleted. The M2M device shall select the ranging opportunity, t, where $t = 1, \ldots, b$, within the backoff window according to the cumulative distribution function

$$F(t) = \frac{N^{t/b} - 1}{N - 1}$$

where b is the backoff window size and N is the value of the configurable system parameter Abnormal Power Down Ranging Opportunity Selection Parameter (see Table 6-330). At the selected ranging opportunity, the M2M device shall transmit the Abnormal Power Down Ranging Preamble Code, which is also a configurable system parameter (see Table 6-330).

The ABS, upon receiving the ranging code, may include a CDMA Allocation A-MAP IE in the next frame identifying the M2M device and provide an allocation sufficiently large to allow the M2M device to transmit an AAI-RNG-REQ message including a Ranging Purpose Indication and the CMAC Tuple. Upon receiving this allocation, the M2M device shall transmit an AAI-RNG-REQ message including a Ranging Purpose Indication with value 0b1111 and Ranging Purpose Indicator Extension with value 0b000 (power outage) and a valid CMAC Tuple. The M2M device shall not repeat sending of a ranging code if it does not receive an allocation from the ABS.

If the T-ABS evaluates the CMAC Tuple as valid and can supply a corresponding authenticating CMAC Tuple, then the T-ABS may reply with an encrypted AAI-RNG-RSP message including the Location Update Response with value 0x0 indicating the completion of the abnormal power down reporting process.

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 6-186 as indicated:

Table 6-186—S-SFH SP3 IE format

Syntax	Size (bits)	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 the same with SCD count as defined in 6.3.5.5.1.2 except that the S-SFH change count and S-SFH SP change bitmap in P-SFH are not changed by update of this field. M2M devices in voluntary network reentry shall decode the S-SFH SP3 every network reentry.
Multiplexing factor of dedicated ranging code	3	Indicate multiplexing ratio of dedicated ranging code 0b000:1 0b001:1/2 0b010:1/4 0b011:1/8 0b100:1/16 0b101:1/32 0b110:1/64 0b111:1/128
...	...	...

6.3.5.5.2.4 Assignment A-MAP IE

Change Table 6-193 as indicated:

Table 6-193—Assignment A-MAP IE types

A-MAP IE Type	Usage	Property
...		
0b1100	Broadcast Assignment A-MAP IE	Broadcast/Multicast

Table 6-193—Assignment A-MAP IE types *(continued)*

A-MAP IE Type	Usage	Property
0b1101	~~*Reserved*~~ UL M2M Persistent Allocation A-MAP IE	N/A
0b1110	~~*Reserved*~~ M2M Multicast Assignment A-MAP IE	~~N/A~~Multicast
0b1111	Extended Assignment A-MAP IE	N/A

Change Table 6-194 as indicated:

Table 6-194—Description of CRC mask

Masking prefix (1-bit MSB)	Remaining 15-bit LSBs	
0b0	*Type Indicator*	*Masking Code*
	0b000	12-bit STID or TSTID
	0b001	Refer to Table 6-195
	0b010	Refer to Table 6-196
	0b011	LSB 12 bits of FMDID or LSB 12 bits of DID
	0b100	12-bit MGID
0b1	15-bit RA-ID: The RA-ID is derived from the AMS's random access attributes [i.e., superframe number (LSB 5bits), frame_index (2 bits), preamble code index for ranging or BR (6 bits) and opportunity index for ranging or BR (2 bits)] as defined below: RA-ID = (LSB 5 bits of superframe number | frame_index | preamble_code_index | opportunity_index)	

Change Table 6-196 as indicated:

Table 6-196—Description of the masking code for type indicator 010

Decimal value	Description
4094	Used to mask Broadcast Assignment A-MAP IE for M2M broadcast assignment or M2M dedicated ranging assignment (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

Change Table 6-204 as indicated:

Table 6-204—CDMA Allocation A-MAP IE[a]

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	
$I_{SizeOffset}$	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 6-204—CDMA Allocation A-MAP IE[a] *(continued)*

Syntax	Size (bits)	Notes
}		
}		
}		

Insert the following text at the end of subclause 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 in the CDMA Allocation A-MAP IE.

6.3.5.5.2.4.13 Broadcast Assignment A-MAP IE

Change Table 6-211 as indicated:

Table 6-211—Broadcast Assignment A-MAP IE[a]

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 ranging channel allocation information for M2M devices or broadcast assignment information for M2M devices
...	...	...
} Else if (Function Index == 0b10) {		
...	...	...
}		
Else {//Function Index == 0b11		
Subfunction Index	1	0b0: Ranging channel assignment information for M2M devices 0b1: Broadcast assignment information for M2M devices
If (Subfunction Index == 0b0) {		
Number of Ranging Opportunities (N)	1	0: One NS-RCH 1: Two NS-RCHs
for (i = 0; i < N; i++) {		

Table 6-211—Broadcast Assignment A-MAP IE[a] *(continued)*

Syntax	Size (bit)	Notes
Subframe Index	3	
Ranging opportunity index	1	Indicates 2-bit Opportunity index of the ranging channel specified in 16.2.15.3. 0b0: 0b01 0b1: 0b10
Dedicated ranging indicator	1	0: This ranging channel is used for purpose of normal ranging 1: This ranging channel is used for the purpose of dedicated ranging indicated in the AAI-PAG-ADV message
}		
Reserved	27/22	
} Else {		
Burst Size	6	Burst size as indicated in the first 39 entries in Table 6-305
Resource Index	11	512 FFT size: 0 in first 2 MSB bits + 9 bits for resource index 1024 FFT size: 11 bits for resource index 2048 FFT size: 11 bits for resource index Resource Index includes location and allocation size.
Long TTI Indicator	1	Indicates number of AAI subframes spanned by the allocated resource. 0b0: 1 AAI subframe (default TTI) 0b1: 4 UL AAI subframes for FDD or all UL subframes for TDD (Long TTI)
Transmission Format	1	0b0: No time domain repetition 0b1: With time domain repetition
If (Transmission Format == 0b1){		
Repetition	2	0b00: No more repetition of the same burst 0b01: The same burst shall be transmitted one more time 0b10: The same burst shall be transmitted two more times 0b11: The same burst shall be transmitted three more times
Reserved	12	Reserved bits
} Else {		
Reserved	14	Reserved bits
}		
}		
}		
}		

Table 6-211—Broadcast Assignment A-MAP IE[a] *(continued)*

Syntax	Size (bit)	Notes
}		

[a]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 6-194. 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.

6.3.5.5.2.4.14 Extended Assignment A-MAP IE

Insert new subclause 6.3.5.5.2.4.14.1 as indicated:

6.3.5.5.2.4.14.1 Fixed M2M Ranging Assignment A-MAP IE

The Fixed M2M Ranging Assignment A-MAP IE is used to allocate the ranging channel of the idle mode fixed M2M device.

The fixed M2M device with FMDID shall apply the 16-bit CRC mask with masking prefix = 0b0, message type indicator = 0b011, and masking code = least significant 12 bits of FMDID to decode the assignment A-MAP IE. The most significant 4 bits of FMDID are included in Fixed M2M Ranging Assignment A-MAP IE.

The fixed M2M device with DID shall apply the 16-bit CRC mask with masking prefix = 0b0, message type indicator = 0b011, and masking code = least significant 12 bits of DID to decode the assignment A-MAP IE. The most significant 6 bits of DID and the paging cycle are included in Fixed M2M Ranging Assignment A-MAP IE.

Table 6-212a—Fixed M2M Ranging Assignment A-MAP IE

Syntax	Size (bits)	Description/Notes
M2M_Fixed_Ranging_Assignment _A-MAP_IE() {		
A-MAP IE Type	4	
Extended Assignment A-MAP IE Type	4	Fixed M2M Ranging Assignment A-MAP IE
M2M Device Identifier Type	1	0: DID 1: FMDID
If (M2M Device Identifier Type == 0) {		
MSB 6 bits of Deregistration Identifier (DID)	6	MSB 6 bits of Deregistration Identifier (DID)
Paging Cycle	4	Paging cycle
}		
If (M2M Device Identifier Type == 1) {		

Table 6-212a—Fixed M2M Ranging Assignment A-MAP IE *(continued)*

Syntax	Size (bits)	Description/Notes
MSB 4 bits of Fixed M2M Device Identifier (FMDID)	4	MSB 4 bits of Fixed M2M Device Identifier (FMDID)
}		
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	512 FFT size: 0 in first 2 MSB bits + 9 bits for resource index 1024 FFT size: 11 bits for resource index 2048 FFT size: 11 bits for resource index Resource index includes location and allocation size.
Burst Size	5	
Reserved	11	
}		

Insert new subclause 6.3.5.5.2.4.16 as indicated:

6.3.5.5.2.4.16 UL M2M persistent allocation A-MAP IE

The UL M2M persistent allocation A-MAP IE is specified in Table 6-212b.

Table 6-212b—UL M2M persistent allocation A-MAP IE

Syntax	Size (bits)	Description/Notes
UL M2M Persistent Allocation A-MAP_IE() {		
A-MAP IE Type	4	UL M2M Persistent Allocation A-MAP_IE
Allocation Period	4	Period of persistent allocation for M2M: 0b0000: de-allocation 0b0001: 2 frames 0b0010: 4 frames 0b0011: 6 frames 0b0100: 5 superframes 0b0101: 10 superframes 0b0110: 25 superframes 0b0111: 50 superframes 0b1000–0b1110: *Reserved* 0b1111: One-time re-allocation

Table 6-212b—UL M2M persistent allocation A-MAP IE *(continued)*

Syntax	Size (bits)	Description/Notes
If (Allocation Period == 0b0000){		
Resource Index	11	Confirmation of the resource index for a previously assigned persistent resource that has been de-allocated 512 FFT size: 0 in first 2 MSB bits + 9 bits for resource index 1024 FFT size: 11 bits for resource index 2048 FFT size: 11 bits for resource index Resource index includes location and allocation size
TTI and Relevance	2	Indicates the TTI type and the location of the UL subframe relevant to this A-MAP. 0b00: long TTI 0b01: default TTI, the first UL subframe relevant to this A-MAP 0b10: default TTI, the second UL subframe relevant to this A-MAP 0b11: default TTI, the third UL subframe relevant to this A-MAP
De-allocation flag	1	0b0: Permanent de-allocation. The resource indicated by the resource index is de-allocated at the UL subframe referenced by this A-MAP IE and the related persistent allocation is terminated. 0b1: One-time de-allocation The resource indicated by the resource index is de-allocated at the UL subframe referenced by this A-MAP IE and the related persistent allocation is retained.
If (De-allocation flag == 0b0) {		
HFA	6	Explicit Index for HARQ Feedback Allocation to acknowledge receipt of de-allocation A-MAP IE
Reserved	12	Reserved bits
} Else {		
Reserved	18	Reserved bits
} Else if (Allocation Period != 0b0000){		
$I_{sizeOffset}$	5	Offset used to compute burst size index
Resource Index	11	512 FFT size: 0 in first 2 MSB bits + 9 bits for resource index 1024 FFT size: 11 bits for resource index 2048 FFT size: 11 bits for resource index Resource index includes location and allocation size

Table 6-212b—UL M2M persistent allocation A-MAP IE *(continued)*

Syntax	Size (bits)	Description/Notes
TTI and Relevance	2	Indicates the TTI type and the location of the UL subframe relevant to this A-MAP. 0b00: long TTI 0b01: default TTI, the first UL subframe relevant to this A-MAP 0b10: default TTI, the second UL subframe relevant to this A-MAP 0b11: default TTI, the third UL subframe relevant to this A-MAP
HFA	3	HARQ Feedback Allocation
N_ACID	2	Number of ACIDs for implicit cycling of HARQ channel identifier. 0b00: 1 0b01: 2 0b10: 3 0b11: 4
Initial_ACID	4	Initial value of HARQ channel identifier for implicit cycling of HARQ channel identifiers.
Reserved	5	Reserved bits
}		
}		

Insert new subclause 6.3.5.5.2.4.17 as indicated:

6.3.5.5.2.4.17 M2M Multicast Assignment A-MAP IE

The M2M Multicast Assignment A-MAP IE is specified in Table 6-212c.

Table 6-212c—M2M Multicast Assignment A-MAP IE

Syntax	Size	Notes
M2M_Multicast Assignment A-MAP_IE() {		
A-MAP IE Type	4	M2M Multicast Assignment A-MAP IE
Burst Size	6	
Resource Index	11	
Long_TTI_Indicator	1	
M2M Group Zone Index	2	M2M Group Zone Index of the corresponding M2M Group Zone ID that the MGID belongs to. It is derived based on the implicit ordering of the M2M GROUP ZONE IDs in the AAI-SCD message transmitted by the ABS.
Reserved	16	

Table 6-212c—M2M Multicast Assignment A-MAP IE *(continued)*

Syntax	Size	Notes
}		

6.3.8.2.4 Ranging channel

6.3.8.2.4.1 Ranging channel for non-synchronized AMSs

Ranging preamble codes

Change Table 6-268 as indicated:

Table 6-268—RP code partition information table, N_{IN}, ~~and~~ N_{HO}, and $N_{M2M\ group}$, for the NS-RCH

Partition Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number of the initial RP codes, N_{IN}	8	8	8	8	16	16	16	16	24	24	24	24	32	32	32	32
Number of the handover RP codes, N_{HO}	8	16	24	32	8	16	24	32	8	16	24	32	8	16	24	32
Number of the M2M Group codes, $N_{M2M\ Group}$	8	8	8	8	16	16	16	16	24	24	24	24	32	32	32	32

6.11 Global values

Change the contents of Table 6-330 as indicated:

Table 6-330—Parameters and constants

System	Name	Time reference	Minimum value	Default value	Maximum value
ABS, AMS, M2M device	T7	Wait for AAI-DSA/ DSC/DSD Response timeout	10 ms[a]	—[a]	1 s[a]
ABS, AMS, M2M device	T8	Wait for AAI-DSA/ DSC Acknowledge timeout	10 ms[a]	—[a]	300 ms[a]
ABS, AMS, M2M device	T10	Wait for Transaction End timeout	600 ms[a]	—[a]	3 s[a]
AMS, M2M device	T14	Wait for AAI-DSX-RVD Timeout	—[a]	—[a]	100 ms[a]
ABS, AMS, M2M device	T22	Wait for AAI-ARQ-Reset	—[a]	—[a]	0.5 s[a]
M2M device	T32	AAI-RNG-ACK reception timeout following the transmission of a ranging preamble code sent by a group delegate	—	—	—
AMS, M2M device	T43	Time the AMS waits for AAI-SLP-RSP, AAI-TRF-IND-RSP, or SCH	—[a]	—[a]	—[a]
AMS, M2M device	T44	Time the AMS waits for AAI-SCN-RSP	—[a]	—[a]	—[a]
AMS, M2M device	T45	Time the AMS waits for AAI-DREG-RSP	—[a]	250 ms[a]	500 ms[a]
ABS	T46	Time the ABS waits for AAI-DREG-REQ in case of unsolicited idle mode initiation from the ABS	50 ms[a]	—[a]	—[a]
ABS, AMS, M2M device	Key agreement MSG#1 Timer	Time prior to resend of PKMv3 Key agreement MSG#1	0.5 s[a]	1 s[a]	2.0 s[a]

Table 6-330—Parameters and constants *(continued)*

System	Name	Time reference	Minimum value	Default value	Maximum value
ABS, AMS, M2M device	Key agreement 3-way handshake Timer	Time prior to resend of PKMv3 Key agreement MSG#2	0.1 s[a]	0.3 s[a]	1.0 s[a]
ABS, AMS, M2M device	TEK Re-Auth Timer	Time prior to sending PKMv3 TEK-Request right after key agreement 3-way handshake	20 ms[a]	40 ms[a]	100 ms[a]
ABS	T58	Minimum duration for ABS to wait for AAI-RNG-CFM message	—[a]	—[a]	—[a]
ABS, AMS, M2M device	ACK timer	This timer is for AAI-MSG-ACK or MAEH. The ACK timer operation is described in 6.2.22	8 frames[a]	—[a]	—[a]
M2M device	T59	Time interval between periodic ranging for fixed M2M devices	—	—	—
M2M device	Abnormal Power Down Ranging Opportunity Selection Parameter	Constant used in defining the CDF used for selecting a ranging opportunity to report an abnormal power down event in idle mode. Refer to 6.2.29.2	—	—	—
M2M device, ABS	Abnormal Power Down Ranging Preamble Code	Ranging preamble code used to indicate an abnormal power down event. Refer to 6.2.29	—	—	—
M2M device	Abnormal Power Down Confirmation timer	Abnormal power down confirmation reception timeout following the transmission of an abnormal power down report	—	—	—

[a] The value shall be increased by (STID-Valid-Periodicity – 1) × 5 ms, if the timer is associated with an M2M device that has a shared STID.

Annex B

(normative)

Definition of AAI MAC control messages

Change B.2 as indicated:

B.2 MAC control message definitions

```
WirelessMAN-Advanced-Air-Interface DEFINITIONS AUTOMATIC TAGS ::=
BEGIN
-- MAC Control Messages
MAC-Control-Message ::= SEQUENCE {
  message MAC-Control-Msg-Type,
  ...
}

MAC-Control-Msg-Type ::= CHOICE {
  -- System information
  aaiSCD AAI-SCD,
  aaiSIIAdv AAI-SII-ADV,
  aaiULPCNi AAI-ULPC-NI,
  -- Network entry / re-entry
  aaiRngReq AAI-RNG-REQ,
  aaiRngRsp AAI-RNG-RSP,
  aaiRngAck AAI-RNG-ACK,
  aaiRngCfm AAI-RNG-CFM,
  aaiSbcReq AAI-SBC-REQ,
  aaiSbcRsp AAI-SBC-RSP,
  aaiRegReq AAI-REG-REQ,
  aaiRegRsp AAI-REG-RSP,
  -- Network exit
  aaiDregReq AAI-DREG-REQ,
  aaiDregRsp AAI-DREG-RSP,
  -- Connection management
  aaiDsaReq AAI-DSA-REQ,
  aaiDsaRsp AAI-DSA-RSP,
  aaiDsaAck AAI-DSA-ACK,
  aaiDscReq AAI-DSC-REQ,
  aaiDscRsp AAI-DSC-RSP,
  aaiDscAck AAI-DSC-ACK,
  aaiDsdReq AAI-DSD-REQ,
  aaiDsdRsp AAI-DSD-RSP,
  aaiGrpCfg AAI-GRP-CFG,
```

```
-- Security
aaiPkmReq AAI-PKM-REQ,
aaiPkmRsp AAI-PKM-RSP,
-- ARQ
aaiArqFbk AAI-ARQ-FBK,
aaiArqDsc AAI-ARQ-DSC,
aaiArqRst AAI-ARQ-RST,
-- Sleep mode
aaiSlpReq AAI-SLP-REQ,
aaiSlpRsp AAI-SLP-RSP,
aaiTrfInd AAI-TRF-IND,
aaiTrfIndReq AAI-TRF-IND-REQ,
aaiTrfIndRsp AAI-TRF-IND-RSP,
-- Handover
aaiHoInd AAI-HO-IND,
aaiHoReq AAI-HO-REQ,
aaiHoCmd AAI-HO-CMD,
aaiNbrAdv AAI-NBR-ADV,
aaiScnReq AAI-SCN-REQ,
aaiScnRsp AAI-SCN-RSP,
aaiScnRep AAI-SCN-REP,
-- Idle mode
aaiPagAdv AAI-PAG-ADV,
aaiPgidInfo AAI-PGID-INFO,
-- Multicarrier
aaiMcAdv AAI-MC-ADV,
aaiMcReq AAI-MC-REQ,
aaiMcRsp AAI-MC-RSP,
aaiCmCmd AAI-CM-CMD,
aaiCmInd AAI-CM-IND,
aaiGlobalConfig AAI-GLOBAL-CFG,
-- Power Control
aaiUlPowerAdj AAI-UL-POWER-ADJ,
aaiUlPsrConfig AAI-UL-PSR-CFG,
-- Collocated Coexistence
aaiClcReq AAI-CLC-REQ,
aaiClcRsp AAI-CLC-RSP,
-- MIMO
aaiSbsMimoFbk AAI-SBS-MIMO-FBK,
aaiMbsMimoFbk AAI-MBS-MIMO-FBK,
aaiMbsMimoReq AAI-MBS-MIMO-REQ,
aaiMbsMimoRsp AAI-MBS-MIMO-RSP,
aaiMbsMimoSbp AAI-MBS-MIMO-SBP,
aaiMbsSoundingCal AAI-MBS-SOUNDING-CAL,
aaiDlIm AAI-DL-IM,
-- FFR
```

```
  aaiFfrCmd AAI-FFR-CMD,
  aaiFfrRep AAI-FFR-REP,
  -- SON
  aaiSonAdv AAI-SON-ADV,
  -- Relay
  aaiARSCfgCmd AAI-ARS-CFG-CMD,
  -- EMBS
  aaiEmbsCfg AAI-EMBS-CFG,
  aaiEmbsRep AAI-EMBS-REP,
  aaiEmbsRsp AAI-EMBS-RSP,
  -- LBS
  aaiLbsAdv AAI-LBS-ADV,
  aaiLbsInd AAI-LBS-IND,
  -- Misc
  aaiL2Xfer AAI-L2-XFER,
  aaiMsgAck AAI-MSG-ACK,
  aaiResCmd AAI-RES-CMD,
  -- M2M device
  aaiMteInd AAI-MTE-IND,
  aaiMgmc AAI-MGMC,
  ...
}

-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
-- Common type definitions
-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
PhyCarrierIndex ::= INTEGER (0..62)
PreambleIndex ::= INTEGER (0..1023)
PreambleIndex2 ::= INTEGER (0..63)
R1PreambleIndex ::= INTEGER (0..127)
PCID ::= BIT STRING (SIZE (48))
PGID ::= BIT STRING (SIZE (16))
PgOffset ::= INTEGER (0..4095)
FMDID ::= BIT STRING (SIZE (16)) -- Fixed M2M deregistration identifier (16 bits)
MGID  ::= BIT STRING (SIZE (12)) -- M2M group identifier (12 bits)
MGSS ::= BIT STRING (SIZE (64)) -- M2M service group security seed (64 bits)
FidChangeCount ::= INTEGER (0..15)
AbsIndex ::= INTEGER (0..255)
MBSZoneID ::= INTEGER (0..127)
EMBSZoneID ::= MBSZoneID
MacProtocolVersion ::= INTEGER (0..255)
BSID ::= BIT STRING (SIZE (48))
STID ::= BIT STRING (SIZE (12))
CID ::= INTEGER (0..65535)
FID ::= INTEGER (0..15)
AKCount ::= INTEGER (0..65535)
```

```
NbrAdvChangeCount ::= INTEGER (0..7)
FAIndex ::= INTEGER (0..255)
IDCell ::= INTEGER (0..1023)
-- IdCell partitioning in Table 6-168
PreamblePart ::= BIT STRING (SIZE (4))
CPLength ::= ENUMERATED {
            one-eighth,
            one-sixteenth,
            one-fourth
}
DREGID ::= BIT STRING (SIZE (12))
PgCycle ::= INTEGER {
            cycle4Superframes (0),
            cycle8Superframes (1),
            cycle16Superframes (2),
            cycle32Superframes (3),
            cycle64Superframes (4),
            cycle128Superframes (5),
            cycle256Superframes (6),
            cycle512Superframes (7),
            cycle32768Superframes (8),
            cycle262144Superframes (9),
            cycle4194304Superframes (10) -- value 0x08 - 0x10 is applied to M2M devices only
           } (0..15)
CMACI ::= ENUMERATED {
            cmacNotPresent,
            cmacPresent
          }
EMBSID ::= STID
MulticastGroupID ::= BIT STRING (SIZE (12))
AMSMobilityLevel ::= ENUMERATED {
            slow,
            medium,
            fast
          }
CenterFreq ::= INTEGER (0..4294967295) -- Unit = Hz
TriggerConditions ::= SEQUENCE {
  hoTriggers SEQUENCE (SIZE (1..64)) OF SEQUENCE {
    hoConditionsList SEQUENCE (SIZE (1..4)) OF SEQUENCE {
      absType INTEGER {
        any (0),
        macroABS (1),
        macroHotZoneABS (2),
        femtoABS (3),
        r1BS (4)
      } (0..15),
```

```
      triggerType INTEGER {
        cinr (0),
        rssi (1),
        rtd (2),
        numConsecutivePSFHsMissed (3),
        rd (4)
      } (0..7),
      triggerFunction INTEGER {
        nbrAbsGreaterThanAbsValue (1),
        nbrAbsLessThanAbsValue (2),
        nbrAbsGreaterThanSabsByRelVal (3),
        nbrAbsLessThanSabsByRelVal (4),
        sabsGreaterThanAbsValue (5),
        sabsLessThanAbsValue (6),
        nbrAbsCarriersGreaterThanThreshold (7)
      } (0..7),
      triggerAction INTEGER {
        respondWithAAI-SCN-REP (1),
        respondWithAAI-HO-REQ (2),
        respondWithAAI-SCN-REQ (3),
        declareABSUnreachable (4),
        cancelHO (5)
      } (0..7),
      triggerValue INTEGER (0..255),
      triggerAvgPara INTEGER {
        one (0),
        oneOver2 (1),
        oneOver4 (2),
        oneOver8 (3),
        oneOver16 (4),
        oneOver32 (5),
        oneOver64 (6),
        oneOver128 (7),
        oneOver256 (8),
        oneOver512 (9)
      } (0..255)
    }
  }
}
M2mShortDataEncryptI ::= ENUMERATED {
           notEncrypted,
           encrypted
         }  -- M2M devices only
M2MGROUPZONEID ::= BIT STRING (SIZE (12))  -- M2M devices only
M2MGROUPZONEIDX ::= BIT STRING (SIZE (2))   -- M2M devices only
BWGrantI ::= ENUMERATED {
```

```
         bwGranted,
         bwNotGranted
        }   -- M2M devices only

-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
-- Some boundary values
-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
maxReceivedCodes INTEGER ::= 32 -- N_Received_Codes(6 bits)
-- Equal to the size of RngAckBitmap
maxRngOpps INTEGER ::= 4
maxRngAckFrames INTEGER ::= 8 -- N_Frame_Identifiers(3 bits)
maxPreassignedCarriers INTEGER ::= 8 -- N_Preassigned_Carriers
maxPhyCarrierIndices INTEGER ::= 64 -- N-PHY-Carrier-Indices
maxNeighborABSs INTEGER ::= 64 -- N-NBR-ABSs
maxNeighborR1BSs INTEGER ::= 64 -- N-NBR-R1BSs
maxCarriers INTEGER ::= 64 -- N-Carrier-Info

-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
-- System Configuration Descriptor Messages
-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- AAI-SCD message
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
AAI-SCD ::= SEQUENCE {
  configChangeCount INTEGER (0..15),
  ...........................................

  msbExtendSuperframeNumber INTEGER (0..1023) OPTIONAL, -- M2M devices only
  m2mConfigChangeCount INTEGER (0..15) OPTIONAL, -- M2M devices only
  probabilityM2MGDSelection INTEGER (0..1023) OPTIONAL, -- M2M devices only
  m2mRangingIndicator CHOICE {
         normalRanging NormalRanging, -- 0x00
         dedicatedRanging DedicatedRanging, -- 0x01
         notAllowedNetworkReentry NULL,-- 0x02
         ...
  } OPTIONAL, -- M2M devices only
  m2mGroupZoneArray SEQUENCE (SIZE (1..4)) OF M2MGROUPZONEID OPTIONAL, -- M2M devices only
  ...
}
NormalRanging ::= SEQUENCE {
  restrictionAccessCalssOne INTEGER (0..1) OPTIONAL,
  restrictionAccessCalssTwo INTEGER (0..1) OPTIONAL,
  restrictionAccessCalssThree INTEGER (0..1) OPTIONAL,
  restrictionAccessCalssFour INTEGER (0..1) OPTIONAL
}  -- M2M devices only
DedicatedRanging ::= SEQUENCE {
```

```
  m2mRangingOpportunitySubframeIndex INTEGER (0..7) OPTIONAL,
  periodicityOfM2mRanging INTEGER {
            everyFrame (0),
            firstFrameInEverySuperframe (1),
            firstFrameIneveryEvenSuperframe (2),
            firstFrameInFourthSuperframe (3)
            -- values 4 to 7 are reserved
          }(0..7) OPTIONAL
}  -- M2M devices only

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- Service Identity Information Advertisement
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
AAI-SII-ADV ::= SEQUENCE {
  -- List of the verbose names of the NSPs. The value of Verbose
  -- NSP Name List is a list of verbose NSP names. The order of the
  -- Verbose NSP Names presented shall be in the same order as the
  -- NSP IDs presented in the NSP List.
  nspInfoList SEQUENCE (SIZE (1..16)) OF NSPID,
  -- Verbose NSP name string
  verboseNspNameList SEQUENCE (SIZE (1..16)) OF VerboseName,
  ...
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- AI_UL Noise and Interference Level Broadcast Message
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
AAI-ULPC-NI ::= SEQUENCE {
  iotSounding IotValue OPTIONAL,
  -- IoT value of Frequency Partition #0, #1, #2, and #3,
  -- quantized in 0.5 dB steps as IoT level from 0 dB to 63.5 dB
  iotFreqPartitionList SEQUENCE (SIZE (4)) OF SEQUENCE {
    iotValue IotValue OPTIONAL
  },
  ...
}

-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
-- Network entry / re-entry messages
-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
-- single type definition for ranging messages
MACAddress ::= BIT STRING (SIZE (48))
MACVersion ::= INTEGER (0..255)
CRID ::= BIT STRING (SIZE (72))
DID ::= BIT STRING (SIZE (12))
CSGID ::= BIT STRING (SIZE (1..24))
```

```
SMS ::= OCTET STRING (SIZE (1..140))
SFID ::= BIT STRING (SIZE (32))
MapMaskSeed ::= BIT STRING (SIZE (15))
IPv4Address ::= OCTET STRING (SIZE (4))
IPPortNumber ::= INTEGER (0..65535)
OperatorID ::= BIT STRING (SIZE (24))
CapabilityIndex ::= INTEGER (0..31)
DeviceClass ::= INTEGER (0..31)
FeatureSupport ::= ENUMERATED {
           notSupported,
           supported
         }
IPv6HomeNetworkPrefix ::= BIT STRING (SIZE (64))

-- complex type definition for ranging messages
FidInfo ::= SEQUENCE {
  flowIdentifier FID,
  fidChangeCount FidChangeCount,
  dlULIndicator ENUMERATED {
           dl,
           ul
         }
}
AddressOrDID ::= CHOICE {
  -- be selected for R1 network mode
  macAddress MACAddress,
  -- be selected for non R1 network mode
  deregistrationID DID
}
MfmBitMap0 ::= SEQUENCE {
  wideBandCqi BIT STRING (SIZE (4)),
  wideBandStcRate BIT STRING (SIZE (3))
} -- M2M devices only
MfmBitMap1 ::= SEQUENCE {
  wideBandCqi BIT STRING (SIZE (4)),
  wideBandStcRate BIT STRING (SIZE (3)),
  wideBandpMI BIT STRING (SIZE (6))
} -- M2M devices only
PagingControlInfo ::= SEQUENCE {
  pagingControllerID PCID,
  pagingGroupID PGID,
  pagingCycle PgCycle,
  pagingOffset PgOffset
}
CsgInfoItem ::= SEQUENCE {
  operatorID OperatorID OPTIONAL,
```

```
  csgIdList SEQUENCE (SIZE (1..64, ...)) OF CSGID
}
LocationUpdateRsp ::= INTEGER {
           successOfLocationUpdate (0),
           failureOfLocationUpdate (1),
           successOfLocationUpdateAndDLTrafficPending (3),
           allowAmsDcrInitReqOrExtensionReq (4),
           rejectAmsDcrInitReqOrExtensionReq (5)
           -- 0x6~0xF: Reserved
} (0..15)

BitmapPlusNewSfInfo ::= SEQUENCE {
  serviceFlowUpdateBitmap BIT STRING (SIZE (16)),
  -- for each 1 bit in the service flow update bitmap
  flowIDUpdate SEQUENCE (SIZE (0..16)) OF SEQUENCE {
    newEMBSID EMBSID,
    newFID FID
  }
}
CurrentSfPlusNewSfInfo ::= SEQUENCE {
  -- for loop of N_EMBS_IDs (maximum value is 7)
  flowInfoUpdate SEQUENCE (SIZE (0..7)) OF SEQUENCE {
    currentEMBSID EMBSID,
    currentFID FID,
    newEMBSID EMBSID,
    newFID FID
  }
}
BitmapAndSfInfo ::= CHOICE {
  -- be selected when serviceFlowUpdateIndicator = 0b0
  bitmapPlusNewSfInfo BitmapPlusNewSfInfo,
  -- be selected when serviceFlowUpdateIndicator = 0b1
  currentSfPlusNewSfInfo CurrentSfPlusNewSfInfo
}
EMBSZoneInfoItem ::= SEQUENCE {
  embsZoneID EMBSZoneID,
  newEMBSZoneID EMBSZoneID OPTIONAL,
  physicalCarrierIndex PhyCarrierIndex OPTIONAL,
  bitmapAndServiceFlowInfo BitmapAndSfInfo
}
SuccessOfLocationUpdate ::= SEQUENCE {
  paginggroupidupdate BIT STRING (SIZE (32)) OPTIONAL,
  pagingoffsetupdate BIT STRING (SIZE (24)) OPTIONAL,
  newPagingCycle PgCycle OPTIONAL,
  newPagingGroupID PGID OPTIONAL,
  newPagingOffset PgOffset OPTIONAL,
```

```
  deregistrationID DID OPTIONAL,
  newFixedM2MDID FMDID OPTIONAL, -- M2M devices only
  newPagingControllerID PCID OPTIONAL,
  embsZoneInfo SEQUENCE (SIZE (1..8)) OF EMBSZoneInfoItem OPTIONAL,
  multicastInfo SEQUENCE (SIZE (1..16)) OF SEQUENCE {
    currentMulticastGroupID MulticastGroupID,
    currentFID FID,
    newMulticastGroupID MulticastGroupID,
    newFID FID
  } OPTIONAL,
  smsMessage SMS OPTIONAL
}
RngRspForHoReentryInfo ::= SEQUENCE {
  multicastInfo SEQUENCE (SIZE (1..15)) OF SEQUENCE {
    currentMulticastGroupID MulticastGroupID,
    currentFID FID,
    newMulticastGroupID MulticastGroupID,
    newFID FID
  } OPTIONAL
}
LocationUpdateResponse ::= SEQUENCE {
  locationUpdateRsp LocationUpdateRsp OPTIONAL,
  locationUpdateResult CHOICE {
    -- locationUpdateResponse = 0x0
    successOfLocationUpdate SuccessOfLocationUpdate,
    others NULL
  }
}
InitialNetworkEntry ::= SEQUENCE {
  amsidOrMacAddress CHOICE {
    -- be selected for advanced network mode and AMSID privacy is
    -- enabled
    amsidStarHashValue MACAddress,
    -- be selected for other cases
    macAddress MACAddress
  },
  macVersion MACVersion,
  -- The bit size represents power level ranging from -15dB (0x00) to
  -- 26dB (0x1F)
  -- The value is determined by AMS after successful initial ranging
  -- process.
  initialOffsetUlpc INTEGER (0..31),
  ...
}
HandoverReentry ::= SEQUENCE {
  stidOrMacAddress CHOICE {
```

```
    -- be selected if STID is not pre assigned
    stidInfo SEQUENCE {
      servingBsid BSID,
      previousSTID STID
    },
    -- be selected if STID is pre assigned
    addressInfo CHOICE {
      -- be selected for R1 network mode
      macAddress MACAddress,
      -- be selected for non R1 network mode
      currentSTID STID
    }
  },
  akCount AKCount OPTIONAL,
  fidList SEQUENCE (SIZE (1..24)) OF FidInfo OPTIONAL,
  ...
}
NetworkReentryFromIdleMode ::= SEQUENCE {
  addressOrDID AddressOrDID,
  addressInfo CHOICE {
    -- be selected for legacy device
    addressOrDID AddressOrDID,
    -- be selected for fixed M2M device
    fmDID FMDID -- M2M devices only
  },
  mfmBitMap CHOICE {
    mfmBitMap0 MfmBitMap0,
    mfmBitMap1 MfmBitMap1
  } OPTIONAL, -- M2M devices only
  pagingControlInfo PagingControlInfo,
  akCount AKCount OPTIONAL,
  fidList SEQUENCE (SIZE (1..24)) OF FidInfo OPTIONAL,
  bwReqSize INTEGER (0..2047) OPTIONAL, -- M2M devices only
  ...
}
LocationUpdate ::= SEQUENCE {
  addressOrDID AddressOrDID,
  pagingControlInfo PagingControlInfo,
  pagingCycleChange PgCycle OPTIONAL,
  pagingCarrierUpdate INTEGER (0..63) OPTIONAL,
  akCount AKCount OPTIONAL,
  amsMobility AMSMobilityLevel OPTIONAL,
  smsMessage SMS OPTIONAL,
  mgidAckIndication BIT STRING (SIZE (1)) OPTIONAL, -- M2M devices only
  m2mShortDataEncryptI M2mShortDataEncryptI OPTIONAL, -- M2M devices only
  curM2MGroupZoneId M2MGROUPZONEID OPTIONAL, -- M2M devices only
```

```
  curMGID SEQUENCE (SIZE (1..16)) OF MGID OPTIONAL, -- M2M devices only
  ...
}

AbnormalPwrDown ::= NULL -- M2M devices only

DCRModeExtension ::= SEQUENCE {
  crid CRID,
  akCount AKCount OPTIONAL,
  ...
}
EmergencyCallSetup ::= SEQUENCE {
  macAddress MACAddress,
  macVersion MACVersion,
  initialOffsetUlpc INTEGER (0..31),
  ...
}
ReentryFromDCR ::= SEQUENCE {
  crid CRID,
  stidInfo SEQUENCE {
    previousServingBsid BSID,
    previousSTID STID
  } OPTIONAL,
  akCount AKCount OPTIONAL,
  fidList SEQUENCE (SIZE (1..24)) OF FidInfo OPTIONAL,
  ...
}
NetworkReentryFromR1 ::= SEQUENCE {
  -- be selected for advanced network mode and AMSID privacy is enabled
  amsidStarHashValue MACAddress OPTIONAL,
  servingBsid BSID,
  macAddress MACAddress,
  akCount AKCount OPTIONAL,
  ...
}
ZoneSwitch ::= SEQUENCE {
  -- be selected for advanced network mode and AMSID privacy is enabled
  zoneSwitchInfo CHOICE {
    receiveTSTID SEQUENCE {
      tstid STID,
      amsidStarHashValue MACAddress OPTIONAL
    },
    receiveBsid SEQUENCE {
      servingBsid BSID,
      previousBasicCid CID
    }
```

```
  },
  akCount AKCount OPTIONAL,
  ...
}
FemtoInterference ::= SEQUENCE {
  akCount AKCount OPTIONAL,
  ...
}
NsEpCallSetup ::= SEQUENCE {
  macAddress MACAddress,
  macVersion MACVersion,
  initialOffsetUlpc INTEGER (0..31),
  ...
}

ReentryProOptimization ::= BIT STRING {
            omitSbcMessages (0),
            omitPkmAuthenticationPhase (1),
            omitRegMessages (2),
            omitIPRefresh (3),
            contextAvailability (4)
          } (SIZE (5))

ImCapabilities ::= BIT STRING { -- 1: supported
            dlPMICoordination (0),
            dlCollaborativeMBSMIMO (1),
            dlClosedLoopMbsMacroDiversity (2),
            ulPmiCombination (3),
            multiBsSoundingCalibration (4)
          } (SIZE (5))

EmbsCapabilities ::= BIT STRING {
            servingAbsOnly (0),
            macroDiversityMultiAbs (1),
            nonMacroDiversityMultiAbs (2)
          } (SIZE (3))

R1R1Support ::= BIT STRING {
            fiveMHz (0),
            tenMHz (1),
            eightDotSevenFiveMHz (2),
            sevenMHz (3)
          } (SIZE (4))

McCapabilities ::= ENUMERATED {
            noMcModes,
```

```
            basicMcMode,
            mcAggregation,
            mcSwitching,
            mcAggregationAndSwitching
}

SoundingAntennaSw ::= ENUMERATED {
            amongDLRx,
            amongULTx
}

ReportMetric ::= BIT STRING {
            absCINRMean (0),
            absRSSIMean (1),
            relativeDelay (2),
            absRTD (3)
          } (SIZE (4))

AmsCapabilities ::= SEQUENCE {
  maxARQBufferSize INTEGER (0..8388607) OPTIONAL,
  maxNonARQBufferSize INTEGER (0..8388607) OPTIONAL,
  multicarrierCapabilities McCapabilities OPTIONAL,
  zoneSwitchingMode FeatureSupport OPTIONAL,
  agpsMethod FeatureSupport OPTIONAL,
  imCapabilities ImCapabilities OPTIONAL,
  embsCapabilities EmbsCapabilities OPTIONAL,
  channelBwAndCyclicPrefix BIT STRING {
            fiveMHz1Over16 (0),
            fiveMHz1Over8 (1),
            fiveMHz1Over4 (2),
            tenMHz1Over16 (3),
            tenMHz1Over8 (4),
            tenMHz1Over4 (5),
            twentyMHz1Over16 (6),
            twentyMHz1Over8 (7),
            twentyMHz1Over4 (8),
            eightDotSevenFiveMHz1Over16 (9),
            eightDotSevenFiveMHz1Over8 (10),
            eightDotSevenFive5MHz1Over4 (11),
            sevenMHz1Over16 (12),
            sevenMHz1Over8 (13),
            sevenMHz1Over4 (14)
          } (SIZE (15)) OPTIONAL,
  frameConfigOfR1R1 R1R1Support OPTIONAL,
  persistentAllocation FeatureSupport OPTIONAL,
  groupResourceAllocation FeatureSupport OPTIONAL,
```

```
  coLocatedCoexistence BIT STRING {
            typeI (0),
            typeII-1 (1),
            typeII-2 (2),
            typeII-3 (3),
            typeIII (4)
          } (SIZE (5)) OPTIONAL,
  hoTriggerMetric ReportMetric OPTIONAL,
  ebbHandover FeatureSupport OPTIONAL,
  -- shall be 0 when multicarrier capability = 0b010 or 0b100
  minHoRentryIntlvInterval INTEGER (0..3) OPTIONAL,
  soundingAntSwitching FeatureSupport OPTIONAL,
  antennaConfig SoundingAntennaSw OPTIONAL
}

CsCapabilities ::= SEQUENCE {
  csSpecificationTypes CsSpecificationTypes OPTIONAL,
  maxNoOfClassificationRules INTEGER (0..65535) OPTIONAL,
  rohc FeatureSupport OPTIONAL,
  phs INTEGER {
            packetPhs (1)
          } (0..1) OPTIONAL,
  -- may only be present AAI-REG-RSP
  resourceRetainTime INTEGER (0..65535) OPTIONAL
}

ClcLimits ::= SEQUENCE {
  type1Indicator BOOLEAN,
  type2Indicator BOOLEAN,
  -- 0: the maximum number of active CLC classes is 8
  -- otherwise: the maximum number = 1..7
  activeClassLimit INTEGER (0..7),
  activeRatioLimit INTEGER (0..63),
  activeIntervalLimit INTEGER (0..31)
}

InterRatOpMode ::= INTEGER {
            singleRadioMode (0),
            multiRadioMode (1)
          } (0..3)

BroadcastRngAck ::= SEQUENCE {
  aggregatedRngAckList SEQUENCE (SIZE (1..maxRngAckFrames)) OF AggregatedRngAck
}
AggregatedRngAck ::= SEQUENCE {
  frameIdentifier FrameIdentifier,
```

```
  rngAckBitmap RngAckBitmap,
  rngOppsStatusList SEQUENCE (SIZE (1..maxRngOpps)) OF RangingOppStatus OPTIONAL
}

FrameIdentifier ::= SEQUENCE {
  superFrameNumber INTEGER (0..3),
  frameIndex INTEGER (0..3)
}

RngAckBitmap ::= BIT STRING {
           rngOpp1 (0),
           rngOpp2 (1),
           rngOpp3 (2),
           rngOpp4 (3)
         } (SIZE (4))

RangingOppStatus ::= SEQUENCE {
  receivedCodesList SEQUENCE (SIZE (1..maxReceivedCodes)) OF SEQUENCE {
    rngPreambleIndex PreambleIndex2,
    rngStatus RangingStatus
  }
}

RangingStatus ::= CHOICE {
  success AdjustmentParameters,
  abort RangingAbort,
  continue AdjustmentParameters
}

Sign ::= ENUMERATED {
           positive,
           negative
         }
AdjustmentParameters ::= SEQUENCE {
  timeingOffsetAdjustment SEQUENCE {
    sign Sign,
    timingOffset INTEGER (1..16384)
  } OPTIONAL, -- unit = 1/Fs
  powerLevelAdjustment SEQUENCE {
    sign Sign,
    powerLevelOffset INTEGER (1..8)
  } OPTIONAL, -- unit = dB
  frequencyOffsetAdjustment SEQUENCE {
    -- unit = 2% of subcarrier spacing
    sign Sign,
    frequencyOffset INTEGER (1..256)
```

```
  } OPTIONAL
}

RangingAbort ::= CHOICE {
  noMoreRanging NULL,
  rngAbortTimer INTEGER (1..65535)
}

RedirectionInfo ::= SEQUENCE {
  absidForNeighborABS BSID,
  preambleForNeighborABS PreambleIndex,
  centerFreqForNeighborABS CenterFreq
}

RangingPurposeIndicatorExtension ::= CHOICE {
  abnormalPwrDown AbnormalPwrDown -- M2M devices only, 0b000
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- Ranging Request
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
AAI-RNG-REQ ::= SEQUENCE {
  -- Indicate whether this message is protected by CM
  cmacIndicator CMACI,
  rangingPurposeDiffMessage CHOICE {
    initialNetworkEntry InitialNetworkEntry,
    handoverReentry HandoverReentry,
    networkReentryFromIdleMode NetworkReentryFromIdleMode,
    idleModeLocationUpdate LocationUpdate,
    dcrModeExtension DCRModeExtension,
    emergencyCallSetup EmergencyCallSetup, -- e.g., E911
    -- Location update for updating service flow management encoding
    -- of E-MBS flows
    locationUpdateEmbsFlows LocationUpdate,
    -- Location update for transition to DCR mode from idle mode
    locationUpdateToDcrMode LocationUpdate,
    -- Reentry from DCR mode, coverage loss or detection of
    -- different ABS restart count
    reentryFromDcr ReentryFromDCR,
    -- Network reentry from a R1 BS
    networkReentryFromR1 NetworkReentryFromR1,
    -- Zone switch to MZONE from LZONE
    zoneSwitch ZoneSwitch,
    locationUpdatePowerDown LocationUpdate,
    -- experiencing "femto interference"
    femtoInterference FemtoInterference,
```

```
    -- NS/EP Call Setup
    nsEpCallSetup NsEpCallSetup,
    networkReentryFromIdleModeR1 NetworkReentryFromIdleModeR1,
    rangingPurposeIndicatorExtension RangingPurposeIndicatorExtension,
    ...
  },
  -- CSG information
  csgInformation SEQUENCE (SIZE (1..15)) OF CsgInfoItem OPTIONAL,

  rangingRetrialInfo BIT STRING {
            successInFirstAttempt(0),
            successInSecondAttempt(1),
            successInThirdAttempt(2),
            successInForthorMoreAttempt(3)
          } (SIZE (4)) OPTIONAL, -- M2M devices only
  ...
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- Ranging Response Message
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
AAI-RNG-RSP ::= SEQUENCE {
  -- set to 1 when an ABS rejects the AMS
  rangingAbortFlag BOOLEAN,
  timerOrSTID CHOICE {
    -- Timer defined by an ABS to prohibit the AMS from attempting
    -- network entry at this ABS, for a specific time duration
    -- Value 65535 (When the received CSGID(s) from the AMS
    -- does not match any of the CSGID(s) of the Femto ABS.
    -- This value indicates the Ranging Abort Timer is not
    -- to be used, and the AMS can range any time.)
    -- Value 0 (do not try ranging again at the ABS)
    -- Value 1-65534, in units of seconds
    rangingAbortTimer INTEGER (0..65535),
    availableRangingRsp RangingResponse
  },
  ...
}

RangingResponse ::= SEQUENCE {
  tempStidOrSTID CHOICE {
    temporarySTID STID,
    stid STID
  } OPTIONAL,
  mapMaskSeed MapMaskSeed,
  amsidOrMacAddress CHOICE {
```

```
  -- selected for advanced network mode and AMSID privacy is enabled
  amsidStarHashValue MACAddress,
  -- selected for other cases
  macAddress MACAddress
},
crid CRID OPTIONAL,
-- response based on ranging purpose sent in AAI-RNG-REQ
rangingPurpose CHOICE {
  emergencyCallSetup SEQUENCE {
    emergencyServiceFID FID (2..15)
  },
  nsEpCallSetup SEQUENCE {
    nsEPServiceFID FID (2..15)
  },
  locationUpdatePowerDown LocationUpdateResponse,
  locationUpdateEmbsFlows LocationUpdateResponse,
  idleModeLocationUpdate LocationUpdateResponse,
  locationUpdateToDcrMode LocationUpdateResponse,
  dcrModeExtension LocationUpdateResponse
},
-- bitmap for Reentry Process Optimization
reentryProcessOptimization ReentryProOptimization OPTIONAL,
activationDeadline INTEGER (0..63) OPTIONAL,
-- 1: perform neighbor station measurement report
nbrBsMeasurementRptIndicator BOOLEAN OPTIONAL,
resourceRetainTime INTEGER (0..255) OPTIONAL,
flowUpdating SEQUENCE (SIZE (1..24)) OF SEQUENCE {
  sfid SFID,
  updateOrDelete ENUMERATED {
          update,
          delete
        },
  dlULIndicator ENUMERATED {
          dl,
          ul
        },
  updatedQoSInfo QosParameter OPTIONAL,
  rohc FeatureSupport OPTIONAL,
  phs INTEGER {
          packetPhs (1)
        } (0..1) OPTIONAL
} OPTIONAL,
unsolicitedBsGrantIndicator BOOLEAN OPTIONAL,
clcResponse CLCResponse OPTIONAL,
csgIdList SEQUENCE (SIZE (1..64, ...)) OF CSGID OPTIONAL,
nbrAbsRedirectInfoList SEQUENCE (SIZE (1..8)) OF RedirectionInfo OPTIONAL,
```

```
  rangingRequestBit BOOLEAN OPTIONAL,
  invalidFIDList SEQUENCE (SIZE (1..24)) OF SEQUENCE {
    fid FID,
    dlULIndicator ENUMERATED {
            dl,
            ul
          }
  } OPTIONAL,
  saidUpdateBitMap BIT STRING (SIZE (16)) OPTIONAL,
  rngRspForHandoverReentry RngRspForHoReentryInfo OPTIONAL,
  mzoneSfidList SEQUENCE (SIZE (1..24)) OF SFID OPTIONAL,
  bwGrantIndicator BWGrantI OPTIONAL, -- M2M devices only
  m2mGroupZoneIndex M2MGROUPZONEIDX OPTIONAL, -- M2M devices only
  mgidUpdateInfo SEQUENCE (SIZE (1..16)) OF SEQUENCE {
    currentMGID MGID,
    newMGID MGID,
    newMGSS MGSS
  } OPTIONAL, -- M2M devices only
  ...
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- Ranging Acknowledge
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
AAI-RNG-ACK ::= SEQUENCE {
  unicastIndication CHOICE {
    broadcastRngAck BroadcastRngAck,
    unicastRngAck RangingStatus
  },
  ...
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- Registration Request
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
CsSpecificationTypes ::= BIT STRING {
            packetIpv4 (1),
            packetIpv6 (2),
            packetEthernet (3),
            packetIpv4OrIpv6 (14),
            multiProtocol (15)
          } (SIZE (16))
MobilityFeaturesSupported ::= BIT STRING {
            hoSupport (0),
            sleepModeSupport (1),
            dcrModeSupport (2),
```

```
          reserved(3)
        } (SIZE (4))

AAI-REG-REQ ::= SEQUENCE {
  amsMacAddress MACAddress,
  amsCapNegotiation AmsCapabilities,
  csCapabilities CsCapabilities,
  hostCfgCapIndicator FeatureSupport,
  -- maximum requested host configuration size is 1023 octets
  requestedHostConfig OCTET STRING (SIZE (0..1023)) OPTIONAL,
  globalCarrierConfigChangeCount INTEGER (0..7),
  amsInitAgpServiceAdaptation FeatureSupport OPTIONAL,
  vendorID VendorID OPTIONAL,
  mobilityFeaturesSupported MobilityFeaturesSupported OPTIONAL,
  supportOfSTIDSharing ENUMERATED {
          notSupported,
          supported
        } OPTIONAL, -- M2M devices only
  rangingBackoffMechanism ENUMERATED {
          decBackoffSupported,
          decBackoffNotSupported
        } OPTIONAL, -- M2M devices only
  ...
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- Registration Response
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
AAI-REG-RSP ::= SEQUENCE {
  stidAndMAPMaskSeed SEQUENCE {
    stid STID,
    mapMaskSeed MapMaskSeed
  } OPTIONAL,
  crid CRID OPTIONAL,
  femtoAbsLdm SEQUENCE {
    startSuperframeOffset INTEGER (0..511),
    availableIntervalLeng INTEGER (0..15),
    unavailableIntervalLeng INTEGER (0..255)
  } OPTIONAL,
  agpsMethod FeatureSupport OPTIONAL,
  imCapabilities ImCapabilities OPTIONAL,
  antennaConfig SoundingAntennaSw OPTIONAL,
  embsCapabilities EmbsCapabilities OPTIONAL,
  persistentAllocation FeatureSupport OPTIONAL,
  groupResourceAllocation FeatureSupport OPTIONAL,
  hoTriggerMetric ReportMetric OPTIONAL,
```

```
  csCapabilities CsCapabilities OPTIONAL,
  ipv4HostAddress IPv4Address OPTIONAL,
  ipv6HomeNetworkPrefix IPv6HomeNetworkPrefix OPTIONAL,
  -- maximum additional host configuration IE size is 1023 octets
  additionalHostConfigIe OCTET STRING (SIZE (0..1023)) OPTIONAL,
  redirectionInfoArray SEQUENCE (SIZE (1..8)) OF RedirectionInfo OPTIONAL,
  csgIdlength INTEGER (1..24) OPTIONAL,
  globalCarrierCfgChangeCount INTEGER (0..7),
  multicarrierCapabilities McCapabilities OPTIONAL,
  csTypeOfDefaultServiceFlow CsSpecification OPTIONAL,
  clcLimits SEQUENCE (SIZE (1..2)) OF ClcLimits OPTIONAL,
  amsInitAgpServiceAdaptation FeatureSupport OPTIONAL,
  vendorID VendorID OPTIONAL,
  mobilityFeaturesSupported MobilityFeaturesSupported OPTIONAL,
  supportOfSTIDSharing ENUMERATED {
           notSupported,
           supported
         } OPTIONAL, -- M2M devices only
  stidSharingInfo SEQUENCE {
    stidValidPeriodicity BIT STRING (SIZE (3)),
    stidValidOffset BIT STRING (SIZE (3))
  } OPTIONAL, -- M2M devices only
  rangingBackoffMechanism ENUMERATED {
           decBackoffSupported,
           decBackoffNotSupported
         } OPTIONAL, -- M2M devices only
  indicationOfGDScheme ENUMERATED {
           notSupported,
           supported
         } OPTIONAL, -- M2M devices only
  ...
}

-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
-- Network exit Messages
-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
IdleModeRetain ::= BIT STRING {
           sbcMessages (0),
           -- Retain info associated with SBC messages
           pkmMessages (1),
           -- Retain info associated with PKM messages
           regMessages (2),
           -- Retain info associated with REG messages
           networkAddr (3),
           -- Retain info associated with network addresses
           msState (4)
```

```
          -- Retain MS state information
         } (SIZE (5))

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- Deregistration Request message
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-

AAI-DREG-REQ ::= SEQUENCE {
  deRegReqCode CHOICE {
    deregFromABSAndNetwork NULL, -- 0x00
    deregAndInitIdleMode DeregAndInitIdleMode, -- 0x01
    unsolicitedDeregRspWithAct05 NULL UnsolicitedDeregRspWithAct05, -- 0x02
    rejectUnsolicitedDeregRsp NULL, -- 0x03
    deregToEnterDcrMode DeregToEnterDcrMode, -- 0x04
    unsolicitedDeregRspWithAct00-01-02-03 NULL, -- 0x05
    ...
  },
  ...
}

DeregAndInitIdleMode ::= SEQUENCE {
.............................................
  ,
  localizedIdle ENUMERATED {
          enterNomalIdle,
          enterLocalized
         } OPTIONAL, -- M2M devices only
  ...
}

DeregToEnterDcrMode ::= SEQUENCE {
  idleModeRetainInfo IdleModeRetain
}

UnsolicitedDeregRspWithAct05 ::= SEQUENCE {
  localizedIdle ENUMERATED {
          enterNomalIdle,
          enterLocalized
         } OPTIONAL, -- M2M devices only
  ...
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- Deregistration Response message
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
AAI-DREG-RSP ::= SEQUENCE {
```

```
  actionCode CHOICE {
    attempyNewNtwkEntry NULL, -- 0x00
    listenAndNoTx NULL, -- 0x01
    listenAndTxOnControlConnection NULL, -- 0x02
    returnAndTxOnActiveConnection NULL, -- 0x03
    amsTerminateNormalOperation NULL, -- 0x04
    initiateIdleMode InitiateIdleMode, -- 0x05
    rejectIdleModeInitiationRequest RejectIdleModeInitiationRequest, -- 0x06
    allowIdleModeInitiationRequest AllowIdleModeInitiationRequest, -- 0x07
    allowConnectionInfoRetention NULL, -- 0x08
    rejectConnectionInfoRetention NULL, -- 0x09
    ...
  },
  ...
}

InitiateIdleMode ::= SEQUENCE {
  localizedIdle ENUMERATED {
            enterNomalIdle,
            enterLocalized
          } OPTIONAL, -- M2M devices only
  pagingCycle PgCycle,
  pagingOffset PgOffset,
  m2mPagingOffset M2MPgOffset OPTIONAL, -- M2M devices only
  pagingControllerId PCID,
  pagingGroupId PGID,

  -- if Network Configuration indicates ABS is attached to the advanced network
  deRegId DREGID OPTIONAL,
  deRegIdInfo CHOICE {
    deRegId DREGID,
    fixedM2Mid FMDID
  } OPTIONAL, -- M2M devices only
  idleModeRetainInfo IdleModeRetain,
  reqDuration INTEGER (0..255) OPTIONAL,
  m2mIdleTimer INTEGER (0..16777215) OPTIONAL  -- M2M devices only
}

RejectIdleModeInitiationRequest ::= SEQUENCE {
  reqDuration INTEGER (0..255) OPTIONAL
}

AllowIdleModeInitiationRequest ::= SEQUENCE {
  localizedIdle ENUMERATED {
            enterNomalIdle,
            enterLocalized
```

```
        } OPTIONAL, -- M2M devices only
  pagingCycle PgCycle,
  pagingOffset PgOffset,
  secondPagingOffset SecondPgOffset OPTIONAL, -- M2M devices only
  m2mPagingOffset M2MPgOffset OPTIONAL, -- M2M devices only
  pagingControllerId PCID,
  pagingGroupId PGID,

  -- if Network Configuration indicates ABS is attached to the advanced network
  deRegId DREGID OPTIONAL,
  deRegIdInfo CHOICE {
    deRegId DREGID,
    fixedM2Mid FMDID
  } OPTIONAL, -- M2M devices only
  idleModeRetainInfo IdleModeRetain,
  m2mIdleTimer INTEGER (0..16777215) OPTIONAL, -- M2M devices only
  transmissionType ENUMERATED {
           none,
           sendData
        } OPTIONAL, -- M2M devices only
  maxNumPagingCycle MaxNumPgCycle OPTIONAL  -- M2M devices only
}

-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
-- Connection management Messages *
-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
.....................................................

-- The mapping of predefined BR index used in quick access message to
-- BR size and BR actions
PredefinedBrIndex ::= SEQUENCE {
  brIndex INTEGER (0..15) OPTIONAL,
  brAction INTEGER {
           ertPS (0),
           aGP (1),
           br (2),
           abnormalPowerDownIndicator (3) -- M2M device only
         } (0..3) OPTIONAL,
  brSize INTEGER (0..2047) OPTIONAL
} -- bytes

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- DSA Request
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
M2MDsaReqParameters ::= SEQUENCE {  -- M2M device only
  minAccessWindow INTEGER (0..1023) OPTIONAL,
```

```
  m2mDeviceMulticast SEQUENCE {
    sfid SFID,
    mgid MGID,
    m2mGroupZoneIndex  INTEGER (0..3)  OPTIONAL,
    mgss MGSS OPTIONAL
  } OPTIONAL
}

.............................................

AAI-DSA-REQ ::= SEQUENCE {
  fidChangeCount FidChangeCount,
  absInitDsaInfo AbsInitDsaInfo OPTIONAL,
  directionIndicator DirIndicator,
  qoSParameters QosParameter OPTIONAL,
  additionalSfInfo AdditionalSfInfo OPTIONAL,
  emergencyIndication BOOLEAN OPTIONAL,
  embsService EMBSService OPTIONAL,
  fullEMBSIDArray SEQUENCE (SIZE (1..8)) OF SEQUENCE {
    embsZoneID EMBSZoneID,
    carrierIndex PhyCarrierIndex,
    embsidFIDMappingList SEQUENCE (SIZE (1..15)) OF SEQUENCE {
      embsid EMBSID,
      fid FID
    }
  } OPTIONAL,
  unicastAvailIntervalBitmap UnicastAvailIntervalBitmap OPTIONAL,
  groupParameterCreateChange GroupParaCreateChange OPTIONAL,
  coupledGroupCreateChange CoupledGroupCreateChange OPTIONAL,
  multicastGroup SEQUENCE (SIZE (1..16)) OF SEQUENCE {
    multicastGroupId MulticastGroupID,
    fid FID
  } OPTIONAL,
  sleepCycleSetting SleepCycleSetting OPTIONAL,
  harqChannelsList SEQUENCE (SIZE (1..16)) OF INTEGER (0..15) OPTIONAL,
  m2mDsaReq M2MDsaReqParameters OPTIONAL, -- M2M device only
  ...
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- DSA Response
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
M2MDsaRspParameters ::= SEQUENCE {   -- M2M device only
  minAccessWindow INTEGER (0..1023) OPTIONAL,
  m2mDeviceMulticast SEQUENCE {
    mgid MGID,
```

```
    m2mGroupZoneIndex  INTEGER (0..3)  OPTIONAL
  } OPTIONAL
}

AAI-DSA-RSP ::= SEQUENCE {
  fidChangeCount FidChangeCount,
  confirmationCode ConfirmationCode,
  fid FID OPTIONAL,
  groupParameterCreateChange SEQUENCE {
    fidArray SEQUENCE (SIZE (1..16)) OF SEQUENCE {
      fid FID OPTIONAL
    }
  } OPTIONAL,
  embsService EMBSService OPTIONAL,
  fullEMBSIDArray SEQUENCE (SIZE (1..8)) OF SEQUENCE {
    embsZoneID EMBSZoneID,
    carrierIndex PhyCarrierIndex OPTIONAL,
    embsidFIDMappingArray SEQUENCE (SIZE (1..15)) OF SEQUENCE {
      embsid EMBSID,
      fid FID
    }
  } OPTIONAL,
  carrierSwitching CHOICE {
    unicastAvailIntervalBitmap UnicastAvailIntervalBitmap,
    aaiEmbsRepMsg NULL
  } OPTIONAL,
  multicastGroup SEQUENCE (SIZE (1..16)) OF SEQUENCE {
    multicastGroupId MulticastGroupID
  } OPTIONAL,
  sleepCycleSetting SleepCycleSetting OPTIONAL,
  m2mDsaRsp M2MDsaRspParameters OPTIONAL, -- M2M device only
  ...
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- DSC Request
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
..............................................

M2MDscReqParameters ::= SEQUENCE {  -- M2M device only
  minAccessWindow INTEGER (0..1023) OPTIONAL,
  mgid MGID OPTIONAL,
  m2mGroupZoneIndex  INTEGER (0..3) OPTIONAL
}

AAI-DSC-REQ ::= SEQUENCE {
```

```
fidChangeCount FidChangeCount,
absInitDscInfo AbsInitDscInfo OPTIONAL,
directionIndicator DirIndicator,
serviceClassName ServiceClassName OPTIONAL,
globalServiceClass GlobalServiceClassName OPTIONAL,
qosParameterSet QosParameterSetType OPTIONAL,
qoSParameters QosParameter OPTIONAL,
sduInterArrival Interval OPTIONAL, -- 0.5ms
timeBase Interval OPTIONAL, -- ms
classifierDSCAction ClassifierDSCAction OPTIONAL,
classificationRules ClassificationRule OPTIONAL,
rohcAttributes RohcAttributes OPTIONAL,
packetErrorRate PacketErrorRate OPTIONAL,
emergencyIndication BOOLEAN OPTIONAL,
embsService EMBSService OPTIONAL,
fullEMBSIDArray SEQUENCE (SIZE (1..8)) OF SEQUENCE {
  embsZoneID EMBSZoneID,
  newEmbsZoneID EMBSZoneID,
  carrierIndex PhyCarrierIndex OPTIONAL,
  serviceFlowUpdateType CHOICE {
    bitmapAndNew SEQUENCE {
      serviceFlowUpdateBitmap BIT STRING (SIZE (16)),
      embsidFIDMappingArray SEQUENCE (SIZE (1..16)) OF SEQUENCE {
        newEMBSID EMBSID,
        newFID FID
      }
    },
    currentAndNew SEQUENCE (SIZE (1..16)) OF SEQUENCE {
      currentEMBSID EMBSID,
      currentFID FID,
      newEMBSID EMBSID,
      newFID FID
    }
  }
} OPTIONAL,
unicastAvailIntervalBitmap UnicastAvailIntervalBitmap OPTIONAL,
groupParameterCreateChange GroupParaCreateChange OPTIONAL,
coupledGroupCreateChange CoupledGroupCreateChange OPTIONAL,
multicastGroupAddition SEQUENCE (SIZE (1..16)) OF SEQUENCE {
  multicastGroupAddedId MulticastGroupID
} OPTIONAL, -- multicast group id to be added
multicastGroupDeletion SEQUENCE (SIZE (1..16)) OF SEQUENCE {
  multicastGroupDeletedId MulticastGroupID
} OPTIONAL, -- multicast group id to be deleted
sleepCycleSetting SleepCycleSetting OPTIONAL,
initialBackoffWindowSize INTEGER (0..15) OPTIONAL,
```

```
  maxBackoffWindowSize INTEGER (0..15) OPTIONAL,
  backoffScalingFactor INTEGER (0..15) OPTIONAL,
  harqChannelsList SEQUENCE (SIZE (1..16)) OF INTEGER (0..15) OPTIONAL,
  m2mDscReq M2MDscReqParameters OPTIONAL, -- M2M device only
  ...
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- DSC Response
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
M2MDscRspParameters ::= SEQUENCE {  -- M2M device only
  minAccessWindow INTEGER (0..1023) OPTIONAL
}

AAI-DSC-RSP ::= SEQUENCE {
  fidChangeCount FidChangeCount,
  sfid SFID OPTIONAL,
  confirmationCode ConfirmationCode,
  groupParameterCreateChange SEQUENCE {
    fidArray SEQUENCE (SIZE (1..16)) OF SEQUENCE {
      fid FID OPTIONAL
    }
  } OPTIONAL,
  sleepCycleSetting SleepCycleSetting OPTIONAL,
  m2mDscRsp M2MDscRspParameters OPTIONAL, -- M2M device only
  ...
}

-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
-- Security Messages
-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
.............................................

PKM-MGTEKRequest ::= SEQUENCE {   -- M2M device only
  mgId MGID
}
PKM-MGTEKUpdate ::= SEQUENCE {   -- M2M device only
  mgId MGID,
  mgss MGSS,
  mgtekCount INTEGER (0..65535)
}
PKM-MGTEKReply ::= SEQUENCE {    -- M2M device only
  newMgss MGSS
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
```

```
-- Privacy Key Management Request
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
AAI-PKM-REQ ::= SEQUENCE {
  pkmMessage CHOICE {
    reauthRequest PKM-ReauthRequest,
    eapTransfer PKM-EAPTransfer,
    keyAgreementMsg2 PKM-KeyAgreementMsg2,
    tekRequest PKM-TEKRequest,
    tekInvalid PKM-TEKInvalid,
    mgtekRequest PKM-MGTEKRequest, -- applied only for M2M device
    ...
  },
  ...
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- Privacy Key Management Response
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
AAI-PKM-RSP ::= SEQUENCE {
  pkmid PKMID,
  pkmMessage CHOICE {
    eapTransfer PKM-EAPTransfer,
    keyAgreementMsg1 PKM-KeyAgreementMsg1,
    keyAgreementMsg3 PKM-KeyAgreementMsg3,
    tekReply PKM-TEKReply,
    tekInvalid PKM-TEKInvalid,
    mgtekUpdate PKM-MGTEKUpdate, -- applied only for M2M device
    mgtekReply PKM-MGTEKReply, -- applied only for M2M device
    ...
  },
  ...
}

..............................................................

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- Neighbor Advertisement
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
AAI-NBR-ADV ::= SEQUENCE {
  changeCount INTEGER (0..7),
  totalNumberOfCellTypes INTEGER (1..8),
  cellType ENUMERATED {
           macro,
           micro,
           macro-hotzone,
           femto,
```

```
            ttrRelay,
            r1-lzone,
            spare2,
            spare1
          },
  totalNumberOfSegments INTEGER (1..16),
  segmentIndex INTEGER (0..15),
  startingABSIndex INTEGER (0..255),
  nbrABSInfoList SEQUENCE (SIZE (1..maxNeighborABSs)) OF NeighborABSInfo,
  nbrM2MGroupZoneInfoList SEQUENCE (SIZE (1..maxNeighborABSs)) OF M2MGROUPZONEID OPTIONAL,
  -- M2M devices only
  mgidMappingInfoList SEQUENCE (SIZE (1..4)) OF MGIDMappingPerZone OPTIONAL, -- M2M devices
  only
  nbrR1BSInfoList SEQUENCE (SIZE (1..maxNeighborR1BSs)) OF NeighborR1BSInfo OPTIONAL,
  -- For ABS type whose system info are not included in AAI_NBR-ADV
  cellTypeInfo CellTypeInfo OPTIONAL,
  -- Optional LDM parameters included when they are to be changed
  ...
}

CellTypeInfo ::= SEQUENCE {
  rangeIDCell SEQUENCE (SIZE (1..maxPhyCarrierIndices)) OF RangeIDCell OPTIONAL
}
RangeIDCell ::= SEQUENCE {
  phyCarrierIndex PhyCarrierIndex,
  idCellStartEnd SEQUENCE {
    startIDCell IDCell,
    endIDCell IDCell
  }
}
NeighborABSInfo ::= SEQUENCE {
  bsID BSID,
  macVersion MacProtocolVersion,
  cpLength CPLength,
  carrierInfoList SEQUENCE (SIZE (1..maxCarriers)) OF CarrierInfo,
  nbrSpecificTrigger Triggers OPTIONAL
}

NbrM2MGZIDInfo ::= SEQUENCE (SIZE (1..4)) OF M2MGROUPZONEID -- M2M devices only

MGIDMappingPerZone ::= SEQUENCE {
  m2mGroupZoneID M2MGROUPZONEID,
  mgidMappingInfo SEQUENCE (SIZE (1..4096)) OF MGIDMappingInfo
} -- M2M devices only

MGIDMappingInfo ::= SEQUENCE {
  newMMGID BIT STRING (SIZE (12)),
```

```
  currentMGID BIT STRING (SIZE (12))
} -- M2M devices only
CarrierInfo ::= SEQUENCE {
  idCell IDCell,
  phyCarrierIndex PhyCarrierIndex,
  pgid PGID,
  sfhChangeCount INTEGER (0..15),
  sfhEncFmt CHOICE {
    -- All parameters of SFHSubpacket shall be included
    fullSubpkt SFHSubpacket,
    -- Parameters of SFHSubpacket are partially included
    deltaInfoCurrentCxr OptSFHSubpacket,
    -- Parameters of SFHSubpacket are partially included
    deltaInfoPrecedingCxr OptSFHSubpacket,
    noSFHIncluded NULL
  }
}
NeighborR1BSInfo ::= SEQUENCE {
  bsID BSID,
  r1PreambleIndex BIT STRING (SIZE (8)),
  phyModeID INTEGER (0..65535),
  channelBW ENUMERATED {
            five-mhz,
            seven-mhz,
            eightPoint75-mhz,
            ten-mhz
           },
  r1BSCenterFreq CenterFreq
}


-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- Idle mode initiation message
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-

-- M2M Specific parameter for Deregistration Response message
SecondPgOffset ::= INTEGER (0..4095) OPTIONAL, -- M2M device only
M2MPgOffset ::= INTEGER (0..1023) OPTIONAL, -- M2M device only
MaxNumPgCycle ::= INTEGER (0..65535) OPTIONAL -- M2M device only

-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
-- Idle Mode Messages
-- *-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
.................................................

-- M2M individual paging (i.e., devices with DID), applied to M2M device only
```

```
MACAddressHash ::= BIT STRING (SIZE (24))
PagedMSInfo ::= SEQUENCE {
  -- if Network Configuration indicates ABS is attached to the advanced network
  deRegId DREGID OPTIONAL,

  -- if Network Configuration indicates ABS is attached to the R1 network
  macAddressHash MACAddressHash OPTIONAL,

  -- if Network Configuration indicates ABS is attached to the advanced network
  pagingCycle PgCycle OPTIONAL,

  actionCode ENUMERATED {
            networkReentry,
            locationUpdate
          },
  m2mAccessType CHOICE { -- M2M device only
    resourceAllocationByMapOffset ResourceAllocationByMapOffset,-- 0x00
    dedicatedRangingByPaging NULL, -- 0x01
    dedicatedRangingByBroadcastmap NULL, -- 0x02
    noDedicatedRanging NULL -- 0x03
  },
  reportCode ENUMERATED { -- M2M device only
            none,
            sendUplinkdata
          } OPTIONAL,
  ...
}

-- M2M Group paging, applied to M2M devices only
GroupPagedMSInfo ::= SEQUENCE { -- M2M device only
  mgId MGID,
  m2mGroupZoneIndex INTEGER (0..3) OPTIONAL,
  actionCode CHOICE {
    networkReentry NetworkReentry, -- 0x00
    locationUpdate GroupLocationUpdate, -- 0x01
    receivingMulticastTrafficWithoutReentry  ReceivingMulticastTrafficWithoutReentry,  --
    0x02
    mgIDReassignment MgIDReassignment, -- 0x03
    ...
  },
  ...
}

NetworkReentry ::= SEQUENCE { -- M2M device only
  initialRangingBackoffStart INTEGER (0..15),
  rangingBackoffWindow ENUMERATED {
            increaseWindow,
```

```
            decreaseWindow
          },
  m2mAccessType CHOICE { -- M2M device only
    resourceAllocationByMapOffset ResourceAllocationByMapOffset,-- 0x00
    dedicatedRangingBySrch DedicatedRangingBySrch, -- 0x01
    dedicatedRangingByNsrch DedicatedRangingByNsrch, -- 0x02
    noDedicatedRanging NULL -- 0x03
  },
  ...
}

GroupLocationUpdate ::= SEQUENCE { -- M2M device only
  initialRangingBackoffStart INTEGER (0..15),
  rangingBackoffWindow ENUMERATED {
            increaseWindow,
            decreaseWindow
          },
  m2mAccessType CHOICE { -- M2M device only
    groupResourceAllocationByMapOffset GroupResourceAllocationByMapOffset,-- 0x00
    dedicatedRangingBySrch DedicatedRangingBySrch, -- 0x01
    dedicatedRangingByNsrch DedicatedRangingByNsrch, -- 0x02
    noDedicatedRanging NULL -- 0x03
  },
  ...
}

ReceivingMulticastTrafficWithoutReentry ::= SEQUENCE { -- M2M device only
  multicastTransStartTime INTEGER (0..255) OPTIONAL
}

MgIDReassignment ::= SEQUENCE { -- M2M device only
  newMgID MGID,
  m2mGroupZoneIndex INTEGER (0..3) OPTIONAL
}

-- M2M Network Access Type, applied to M2M devices only
ResourceAllocationByMapOffset ::= SEQUENCE { -- M2M device only
  offset INTEGER (0..255)
}

GroupResourceAllocationByMapOffset ::= SEQUENCE { -- M2M device only
  offset INTEGER (0..255),
  resourceMonitorTimer INTEGER (0..255)
}

DedicatedRangingBySrch ::= SEQUENCE { -- M2M device only
```

```
  groupPagingChangeCount INTEGER (0..3) OPTIONAL,
  groupAccessProbability INTEGER { -- M2M device only
           twentyFive (0),
           fifty (1),
           hundred (2)
           -- value 3 is reserved
         } (0..3) OPTIONAL,
  m2mRangingOpportunitySubframeIndex INTEGER (0..7), -- M2M device only
  periodicityOfM2mRanging INTEGER { -- M2M device only
           everyFrame (0),
           firstFrameInEverySuperframe (1),
           firstFrameIneveryEvenSuperframe (2),
           firstFrameInFourthSuperframe (3)
           -- values 4 to 7 are reserved
         } (0..7),
  dedicatedChannelAllocationTimer INTEGER (0..255) OPTIONAL -- M2M device only
}

-- M2M Individual paging (i.e., devices with FMDID), M2M device only
IndividualPagedMSInfo ::= SEQUENCE { -- M2M device only
  fixedM2Mid FMDID OPTIONAL,
  reportCode ENUMERATED { -- M2M device only
           none,
           sendUplinkdata
         } OPTIONAL,
  actionCode ENUMERATED {
           networkReentry,
           locationUpdate
         },
  m2mAccessType CHOICE { -- M2M device only
    resourceAllocationByMapOffset ResourceAllocationByMapOffset,-- 0x00
    dedicatedRangingByPaging NULL, -- 0x01
    dedicatedRangingByBroadcastmap NULL, -- 0x02
    noDedicatedRanging NULL -- 0x03
  }
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- Paging Advertisement
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
AAI-PAG-ADV ::= SEQUENCE {
  -- HTC paging
  ................................................

  -- M2M Individual Paging (i.e., Devices with DID), M2M device only
  pagingGroupInfoArray SEQUENCE (SIZE (1..4)) OF SEQUENCE { -- M2M device only
```

```
    pagedMSInfoArray SEQUENCE (SIZE (1..32)) OF PagedMSInfo
  },
  -- M2M Group Paging, M2M device only
  groupPagedMSInfoArray SEQUENCE (SIZE (1..32)) OF GroupPagedMSInfo, -- M2M device only

  -- Fixed M2M Individual Paging (i.e., Devices with FMDID), M2M device only
  individualPagingGroupInfoArray SEQUENCE (SIZE (1..4)) OF SEQUENCE { -- M2M device only
    individualPagedMSInfoArray SEQUENCE (SIZE (1..32)) OF IndividualPagedMSInfo
  },

  initialRangingBackoffStart INTEGER (0..15) OPTIONAL, -- M2M device only
  rangingBackoffWindow ENUMERATED { -- M2M device only
           increaseWindow,
           decreaseWindow
         } OPTIONAL,
  m2mRangingOpportunitySubframeIndex INTEGER (0..7) OPTIONAL, -- M2M device only
  periodicityOfM2mRanging INTEGER { -- M2M device only
           everyFrame (0),
           firstFrameInEverySuperframe (1),
           firstFrameIneveryEvenSuperframe (2),
           firstFrameInFourthSuperframe (3)
           -- values 4 to 7 are reserved
         } (0..7) OPTIONAL,
  dedicatedChannelAllocationTimer INTEGER (0..255) OPTIONAL, -- M2M device only
  extensionFlag ENUMERATED {
           lastFragmentOfPagAdv,
           moreFragmentOfPagAdv
         },
  m2mExtensionFlag ENUMERATED { -- M2M device only
           lastFragmentOfPagAdv,
           moreFragmentOfPagAdv
         } OPTIONAL,
  emergencyAlert BOOLEAN OPTIONAL
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
-- AAI-MTE-IND message (M2M device only)
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
AAI-MTE-IND ::= SEQUENCE {
  mgidToStopTransmission SEQUENCE (SIZE (1..4)) OF SEQUENCE {
    mgid MGID,
    m2mGroupZoneIndex INTEGER (0..3)
  }
}

-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
```

```
-- AAI-MGMC message (M2M device only)
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
AAI-MGMC ::= SEQUENCE {
  actionCode INTEGER {
           reassign (0)
         } (0..3),
  mgidToUpdate SEQUENCE (SIZE(1..4)) OF SEQUENCE {
    currentMGID MGID,
    newMGID MGID,
    m2mGroupZoneIndex  INTEGER (0..3)
  } OPTIONAL
}

END
```