Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**	
Title	**Correction to Padding of CMAC**	
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Re:	802.16e late comment by Pieter-Paul Giesberts	
Abstract	The padding of the prepended CMAC data is meant to align to 128 bits, but it doesn't. This proposal makes it align to 128 bits and aligns all the fields to a byte boundary.	
Purpose	Consider and adopt this text into the 802.16e draft as a resolution of late comment by Pieter-Paul Giesberts.	
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Correcting Padding of 802.16e CMAC

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The following text amends the 802.16e CMAC management frame protection text to align the first block to 128 bits, consistent with the AES block size and aligns the internal fields to 8 bit boundaries.

[Change the text of 7.5.4.4.1 as indicated:]

7.5.4.4.1 Calculation of CMAC Value

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 downlink authentication key CMAC_KEY_D shall be used for authenticating messages in the downlink direction. The uplink authentication key CMAC_KEY_U shall be used for authenticating messages in the uplink direction. Uplink and downlink message authentication keys are derived from the AK (see 7.5.4 below for details).

For authentication multicast messages (in the DL only) a CMAC_KEY_GD shall be used (one for each group), group authentication key is derived from GKEK

The CMAC-Digest and CMAC Tuple attributes shall be only applicable to the PKM version 2. In the PKM version 2 protocol, the CMAC key sequence number in the CMAC tuple shall be equal to the 4-bit AK sequence number of the AK from which the CMAC_KEY_x was derived, expressed as an unsigned 8 bit byte.

The CMAC Packet Number Counter (CMAC_PN_*) is a 4 byte sequential counter that is incremented in the context of UL messages by the SS, and in the context of DL messages by the BS,. The BS will also maintain a separate CMAC_PN_* for multicast packets per each GSA and increment that counter in the context of each multicast packet from the group. For MAC messages that have no CID e.g. RNG-REQ message, the CMAC_PN_* context will be the same as used on the basic CID. If basic CID is unknown (e.g. in network reentry situation) then CID 0 should be used.

The CMAC Packet Number Counter, CMAC_PN_*, is part of the CMAC security context and must be unique for each MAC management message with the CMAC tuple or digest. Any tuple value of {CMAC_PN_*, AK} shall not be used more than once. The reauthentication process should be initiated (by BS or SS) to establish a new AK before the CMAC_PN_* reaches the end of its number space.

The digest shall be calculated over a field consisting of the CMAC key sequence number followed by the CMAC Packet Number Counter, expressed as an unsigned 32-bit number, followed by the 16-bit Connection ID on which the message is sent, followed by 72-bit of zero padding (for the header to be aligned with AES block size) and followed by the entire MAC management message with the exception of the CMAC-TLV.

The least significant bits of the digest shall be truncated to yield a 64-bit length digest. The CMAC key sequence number shall be equal to the 4-bit AK sequence number of the AK from which the CMAC_KEY_x was derived, expressed as an unsigned 8 bit byte..

i.e.:

CMAC value <= Truncate64 (CMAC (CMAC_KEY_*, CMAC key sequence number | CMAC_PN | CID |72~~16~~-bit zero padding | MAC_Management_Message))

If the digest is included in an MPDU that has no CID, e.g. A RNG-REQ message, the CID used shall take the value of the basic CID. If basic CID is unknown (e.g. in network reentry situation) then CID 0 should be used.