Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**	
Title	**IEEE 802.16g Amendments for IEEE 802.21 MIH Information Service Support for Network Selection**	
Date Submitted	**2007-01-17**	
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Re:	IEEE 802.16 Session #47 in London	
Abstract	This contribution proposes the updates of IEEE 802.16g D5 document in order to support IEEE 802.21 Media Independent Information Services.	
Purpose	Update 802.16g draft to support Media Independent Handover	
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802.16g Amendments for 802.21 Services

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1. Introduction

In order for MS to enter 802.16 network for the first time, MS shall obtain UCD and DCD then will commence network entry procedure by initiating initial ranging procedure. Current 802.16 specifications specify operator ID and 802.16g draft specifies delivery mechanism of Network Service Provider IDs. Network selection depending on IDs has some limitations. That is, mapping information of IDs shall be stored on the MS and freshness of stored information shall be ensured. Sometimes more information is required to make right decision for network selection. In addition to 802.16 ID based network discovery and selection, 802.21 information service can provide necessary information for network discovery and selection when MS does not have pre-stored information or needs more information on the network.

1.1 Interworking procedures: MIH Information Services

This clause describes the actions and the procedures to enable network selection for IEEE 802.16 MS as well as the seamless interworking of a multi-access capable MSs with other non-802.16 access technologies or when other non-802.16 specific network protocols are involved. It specifies the transport mechanisms to advertise services for network selection. IEEE 802.21 MIH capability is included in the DCD in order for MSs to use network selection using IEEE 802.21 Information service. IEEE 802.21 Information service is used for Queries and Query Responses. The network selection information delivery mechanism using IEEE 802.21 Information service is supported using two options:

i) Broadcast mechanism
ii) Unicast mechanism

1.1.1 Broadcast Mechanism

The MS obtains the IEEE 802.21 capability from DCD. In the IEEE 802.21 capability indications of DCD, three key services supported by the current BS are indicated. When information service during network entry is allowed, after basic capability negotiation, MS can send Queries embedded in PKM-REQ. BS can identify MSs with MIH capability during basic capability negotiation procedure. Upon receipt of MIH query frame in PKM-REQ MAC management message BS generates a PKM-RSP with Cycle TLV. NCMS of the BS proxies or forwards the query request to the backbone network to retrieve the query results. This NCMS procedure with backbone network is out of scope of IEEE 802.16g and shall not be specified in the draft. The response message from the backbone network (information server) will be queued in the BS for broadcast delivery at later time. BS's scheduling information of broadcast delivery is informed to the MS through the Cycle TLV of PKM-RSP transmitted to the MS. MS shall monitor the frame indicated by Cycle TLV. If the SII-ADV message with query response is not delivered, MS shall monitor next cycle for the message. MS can wait until predetermined counter is exhausted. While waiting for the frame indicated by Cycle TLV, MS does not need to remain active. BS shall only transmit the PKM-RSP with Query Response only in the frame indicated by Cycle TLV. PKM-RSP

message carrying Query Response MIH frame TLV includes Query ID which was assigned during the initial request message exchange. The following figure shows the message sequence.

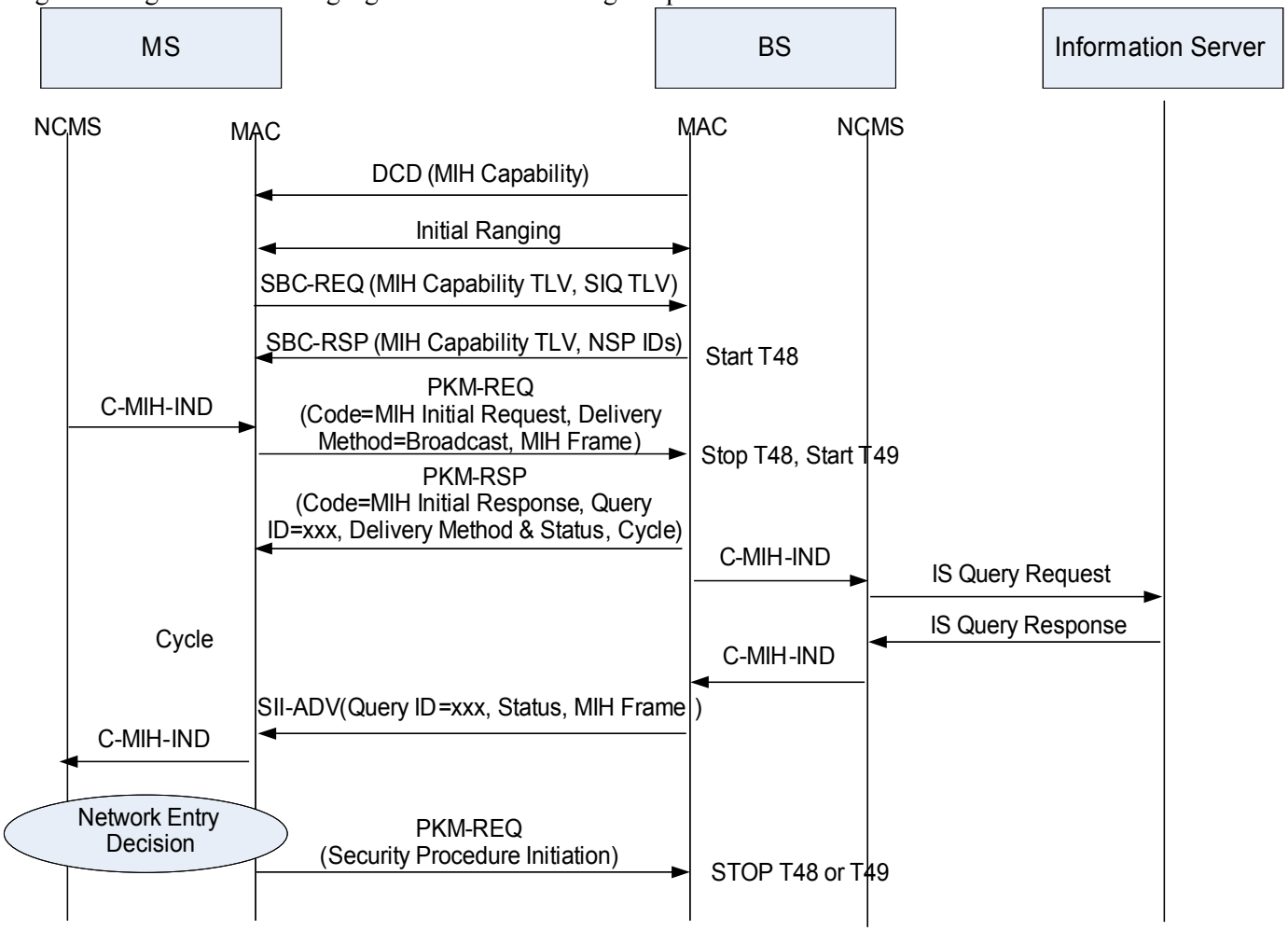

Figure 1. Network Selection information delivery using broadcast delivery method.

1.1.2 Unicast Mechanism

The MS obtains the IEEE 802.21 capability from DCD. In the IEEE 802.21 capability indications of DCD, three key services supported by the current BS are indicated. When information service during network entry is allowed, after basic capability negotiation procedure, MS can send Queries embedded in PKM-REQ. BS can identify MSs with MIH capability during basic capability negotiation. Upon receipt of MIH frame in PKM-REQ MAC management message BS generates a PKM-RSP with Query ID TLV and Cycle TLV. NCMS of the BS proxies or forwards the request to the backbone network to retrieve the query results. This NCMS procedure with backbone network is out of scope of IEEE 802.16g and shall not be specified in the draft. The response message from the backbone network (information server) will be queued in the BS for unicast delivery at later time. BS's scheduling information of query response delivery is informed to the MS in the Cycle TLV of PKM-RSP transmitted to the MS. MS shall check whether MIH_Polling_IE is included in the UL-MAP of the frame indicated by Cycle TLV. When MIH_Polling_IE exists in the UL-MAP, MS shall send PKM-REQ with same Query ID which was assigned during the initial message exchange. Upon receipt of the PKM-REQ from the MS which is the query originator, BS can make sure whether MS still stays to receive Query response message and BS transmits PKM-RSP containing Query Response MIH frame to the MS. BS only includes MIH_Polling_IE in the UL-MAP when the Query Response is received from the backbone network. MS can wait the delivery of MIH_Polling_IE until predetermined counter is exhausted. While waiting for the frame indicated by Cycle

TLV, MS does not need to remain active. The following figure shows the message sequence.

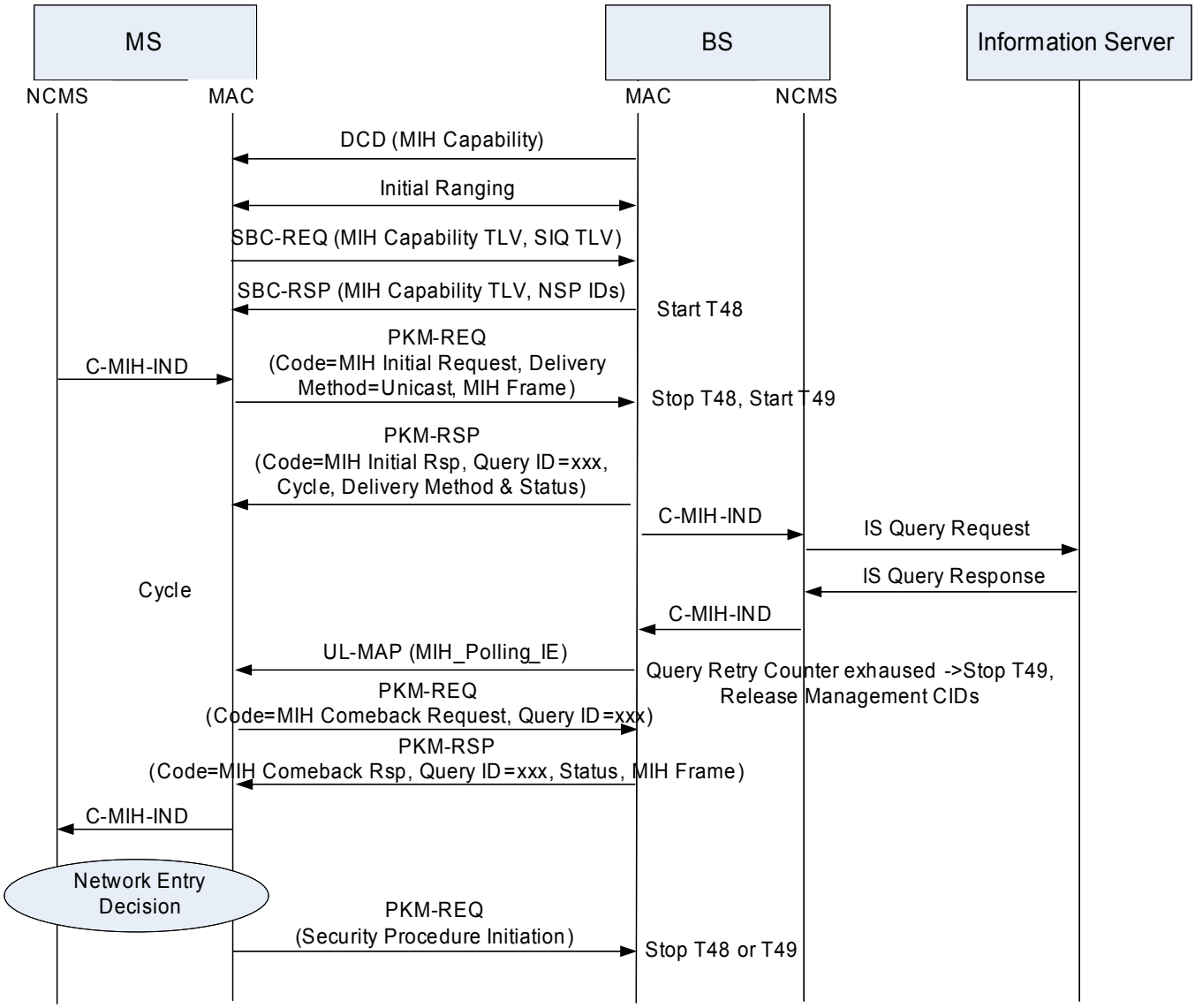

Figure 2. Network Selection information delivery using unicast delivery method.

2. Proposed Text Change

Remedy 1:

MIH Capability advertisement through DCD shall carry more capabilities using reserved bits.
[In 11.4.1 DCD channel encoding, page 21, line 26, Modify]:

Name	Type	Length	Value	PHY Scope
MIH Capability Support	55	1	Indicates the capability of IEEE 802.21 Media Independent Handover Services. Setting each bit to 1 indicates corresponding service is supported. Setting bit # 0 to 1 indicates MIH services indicated through bit #1~3 are supported by the current BS. Setting more than one of bit #1~3 without setting bit #0 indicates existence of an MIH service entity within the Layer 2 broadcast domain of the current BS. In this case transport MIH MAC management message (MOB_MIH-MSG) is not supported by the BS. When bit #4 is set to be 1, MS is allowed to transmit MIH information service request MIH function frame TLV (11.20.1) in PKM-REQ. When bit #5 is set to be 1, MS is allowed to transmit MIH function frame TLV (11.20.1) for ES/CS Capability discovery in PKM-REQ Bit #0=MIH (Media Independent Handover) ~~Capability not~~ support~~ed~~ ~~1=MIH Capability supported~~ Bit #1 = Event Service support Bit #2 = Command Service support Bit #3 = Information Service support Bit #4 = Information Service support during network entry Bit #5 = ES/CS capability discovery support during network entry Bit #6~7: *reserved*	All

Remedy 2:

In order for an MS to negotiate MIH capability, MIH capability negotiation during registration is added in the current draft. This capability negotiation shall be changed to be performed during basic capability negotiation. More detailed capability negotiation is required.

[In 11.7.26 MIH Capability Supported TLV, page 22, line 38, modify]:

11.~~7.26.~~8.9 MIH Capability Supported TLV

The "MIH Capability Supported" TLV indicates if MIH is supported. MS and BS that support the MIH handover function shall identify themselves by inclusion of the MIH capability supported. MS and BS that do not support the 802.21 MIH handover function shall not support the MOB_MIH-MSG management message. However, BS may indicate the existence of the MIH service entity within the layer 2 broadcast domain of the current BS by setting bit # 0 to be 0 and corresponding services bits of MIH service entity to be 1. In this case, BS doesn't support MOB_MIH-MSG MAC management message and MS shall access the MIH service entity using layer 2 data frames. BS may provide network discovery query mechanism during network entry using MIH frames. BS shall indicate capability of the network discovery query using bit #4 and 5.

[In 11.7.26 MIH Capability Supported TLV, page 22, line 38 ,modify]:

Type	Length	Value	Scope
46	1	Indicates the capability of IEEE 802.21 Media Independent Handover Services. Setting each bit to 1 indicates corresponding service is supported. Setting bit # 0 to 1 indicates MIH services which further indicated through bit #1~3 are supported. In REG-RSP transmitted from BS, more than one of bit #1~3 without setting bit #0 may be set which indicates existence of an MIH service entity within the Layer 2 broadcast domain of the current BS. In this case transport MIH MAC management message (MOB_MIH-MSG) is not supported by the BS. When bit #4 is set to be 1, MS is allowed to transmit MIH information service request MIH function frame TLV (11.20.1) in PKM-REQ. When bit #5 is set to be 1, MS is allowed to transmit MIH function frame TLV (11.20.1) for ES/CS Capability discovery in PKM-REQ Bit #0=MIH (Media Independent Handover) ~~Capability not~~ support~~ed~~ ~~1=MIH Capability supported~~ Bit #1 = Event Service support Bit #2 = Command Service support Bit #3 = Information Service support Bit #4 = Information Service support during network entry Bit #5 = ES/CS capability discovery support during network entry Bit #6~7: *reserved*	~~REG-REQ~~ ~~REG-RSP~~ SBC-REQ SBC-RSP

Remedy 3:

When bit #4 and 5 are set of MIH Capability support TLV, PKM-REQ and PKM-RSP are used to carry IEEE 802.21 information service Query or ES/CS Capability discovery MIH frame.

[In 6.3.2.3.9 Privacy key management (PKM) messages, Modify Table 26 and insert in page 13, line 17]:

Table 26-PKM message code

Code	PKM message type	MAC Management message name
…	…	…
31	MIH Initial Request	PKM-REQ
32	MIH Initial Response	PKM-RSP
33	MIH Comeback Request	PKM-REQ
34	MIH Comeback Response	PKM-RSP
~~29~~35~255	*Reserved*	

[In 6.3.2.3.9.29 MIH Initial Unicast Query, insert in page 13, line 17]:

6.3.2.3.9.29 MIH Initial Request message

This message is sent by the MS to the BS to query using MIH function frame.
Code: 31
Attributes are shown in Table 37s

Table 37s – MIH Initial Request attributes

Attribute	Contents
MIH Function Frame Type	Indicates type of MIH Function Frame (11.20.2)
Delivery Method and Status Code	Indicates the delivery method of query response. (11.20.4)
MIH Function Frame	MIH Function Frame TLV received through C-MIH-IND (11.20.1)

6.3.2.3.9.30 MIH Initial Response

This message is sent by the BS to the MS to response to the query.
Code: 32
Attributes are shown in Table 37t

Table 37t – MIH Initial Response attributes

Attribute	Contents
Cycle	Indicates the delivery method of query response. (11.20.2)
Query ID	Used to map query and query response (11.20.5)

Delivery Method and Status Code	Indicates the delivery method and status code. (11.20.4)

6.3.2.3.9.31 MIH Comeback Request

This message is sent by the MS to the BS to retrieve query response. This message shall be only transmitted when BS polls the MS using MIH_Polling_IE in the UL-MAP.
Code: 33
Attributes are shown in Table 37u

Table 37u – MIH Comeback Request attributes

Attribute	Contents
Query ID	Used to map query and query response (11.20.5)

6.3.2.3.9.32 MIH Comeback Response

This message is sent by the BS to the MS to deliver query response.
Code: 34
Attributes are shown in Table 37v

Table 37v – MIH Initial Response attributes

Attribute	Contents
MIH Function Frame Type	Indicates type of MIH Function Frame. Only included when MIH Function Frame is present. (11.20.2)
Query ID	Used to map query and query response (11.20.5)
Delivery Method and Status Code	Indicates the delivery method and status code. (11.20.4)
MIH Function Frame	MIH Function Frame TLV received through C-MIH-IND (11.20.1)

Remedy 5:

When bit #4 and 5 are set of MIH Capability support TLV and broadcast mechanism is negotiated, SII-ADV message is used to carry Query response.

[In 6.3.2.3.63 Service Identity Information (SII-ADV) message, page14, line 41, Insert:]:

A BS may use the SII-ADV message to broadcast a list of Network Service Provider (NSP) Identifiers. The message may be broadcast periodically without solicitation or could be solicited by an (M)SS. This message is sent from the BS to all MSs on a broadcast CID. Assignment method, administration, and usage of NSP Ids are outside the scope of this standard. The BS may use the SII-ADV message to deliver IEEE 802.21 MIH function frame which carries query response. SII-ADV is broadcasted at pre-determined cycle which was notified to the MS during initial query.

[In 6.3.2.3.63 Service Identity Information (SII-ADV) message, page14, line 56, Insert:]:

The SII-ADV may contain the following TLVs:

NSP List TLV (11.1.8.1)

The NSP LIST TLV is a TLV that contains one or more Network Service Provider 24 bit Identifiers.

NSP Change Count TLV (11.1.8.2)

The NSP Change Count TLV indicates a change of the NSP list. It will be increased by one (module 256) whenever the NSP list changes.

Query ID (11.20.4)

Query ID is returned by the BS in the PKM-RSP for the MS's Query request to indicate that a backbone query through NCMS is being carried out on behalf of the MS.

MIH Function frame type (11.20.2)

MIH Function frame type TLV indicates the service type of MIH Function Frame TLV

MIH Function frame (11.20.1)

MIH Function frame TLV is used to carry MIHF Frame received through C-MIH-IND primitive from NCMS.

Remedy 4:

When bit #4 and 5 are set of MIH Capability support TLV, PKM-REQ and PKM-RSP are used to carry IEEE 802.21 information service Query or ES/CS Capability discovery MIH frame. When broadcast mechanism is negotiated SII-ADV message is used to carry Query response. During the first query message exchange, Cycle TLV is included for MS power management.

[In 11.20 MIH message encoding, page 28, line 4, Modify: Remove Name Column, Insert Scope Column]:

11.20 MIH message encodings

11.20.1 MIH Function frame

~~These~~ This TLV is used to ~~management frames~~ carry MIHF Frame described in subclause 8.2~~.1~~ of IEEE Std 802.21 under L2 transport option ~~2~~ of Table ~~17~~23~~, subclause 8.2~~. MIH function frame shall be received and transmitted using C-MIH-IND primitive from/to NCMS.

~~Name~~	Type	Length	Value	Scope
~~MIHF_Frame_package~~	??	variable	MIHF Frame described in subclause 8.2.1 of IEEE 802.21 under transport option 3 of Table 17, subcluse 8.2.	MOB_MIH-MSG PKM-REQ PKM-RSP SII-ADV

11.20.2 MIH Function frame type

This TLV indicates the service type of MIH Function Frame.

Type	Length	Value	Scope
??	1	0: ES/CS MIH Capability Discovery 1: Event Service 2: Command Service 3: Information Service 4-255: *Reserved*	MOB_MIH-MSG PKM-REQ PKM-RSP SII-ADV

11.20.3 Cycle

Cycle TLV is included to indicate when Query Response is expected. MS shall only to check the cycle for the SII-ADV transmission in case of broadcast transmission method or the MIH_Polling_IE in the UL-MAP in case of unicast transmission method, and MS can switch to power saving mode while waiting for the Cycle.

Type	Length	Value	Scope
	1	Cycle at which the Query Response may be transmitted.	PKM-RSP

11.20.4 Delivery Method and Status Code

This TLV is included in order for MS and BS to negotiate preferred delivery method (broadcast or unicast). BS may transmit the status of the requested information. When MS include this TLV for delivery method negotiation, MS shall set the status code as to be null (0x0000).

Type	Length	Value	Scope
	1	Bit #0: Unicast Bit#1: Broadcast Bit#2~6: Status code 0x0000: Null 0x0001: MIH_Not_Supported 0x0002: Requested_Delivery_Method_Not_Supported 0x0003: Request_Info_Not_Available 0x0004: Response_Not_Received Bit#7: Reserved	PKM-REQ PKM-RSP

11.20.4 Query ID

Query ID is returned by the BS in the PKM-RSP for the MS's Query request to indicate that a backbone query through NCMS is being carried out on behalf of the MS. When the MS transmit the PKM-REQ polled by MIH_Polling_IE, the MS shall use the Query ID to retrieve the response. The Query ID is included in the PKM-RSP carrying Query Response in both unicast and broadcast delivery methods.

Type	Length	Value	Scope
	1	To be used for request to retrieve the response in the unicast mechanism. BS shall include this TLV in PKM-RSP	PKM-REQ PKM-RSP

		carrying Query Response.	SII-ADV

Remedy 5:

Management CID related timer T9 Timer operation and counter Update

[In 11.4.1 DCD channel encoding, page 20, line 15, Modify]:

Table 343 – Parameters and constants

System	Name	Time reference	Minimum Value	Default Value	Maximum Value
BS	T48	The time allowed between the SBC response and PKM-REQ. If the BS does not receive a PKM-REQ within the time, management CIDs shall be released.			
BS	T49	The time allowed between the PKM-REQ (Code=31) and PKM-REQ for security procedure initiation. If the BS does not receive a PKM-REQ which initiates the security procedure within the time, management CIDs shall be released.			
MS, BS	Query Retry Counter	MS: In case of broadcast method, MS shall monitor the frame at the every cycle time for transmission of SII-ADV up to the Query Retry Counter value. BS: In case of unicast method, BS shall poll the MS to deliver PKM-RSP carrying Query Response up to the Query Retry Counter value. If the BS does not receive a PKM-REQ (code=33) until the counter is exhausted, management CIDs shall be released.	3	3	

~~*Remedy 7:*~~

~~*[8.4.5.4.4.1 UL-MAP Extended IE format, page 16, line 30, Insert subsection 8.4.5.4.4.1 as it follows]:*~~

~~8.4.5.4.4.1 UL-MAP Extended IE format~~

Table 290a. Extended UIUC Code Assignment for UIUC 15

Extended UIUC	Usage
00	Power_control_IE
…	…
0B	MIH_Polling_IE
0B0C…0F	Reserved

[8.4.5.4.29 MIH_Polling_IE, page 16, line 32, Insert subsection 8.4.5.4.29 as it follows]:

8.4.5.4.29 MIH_Polling_IE

BS's scheduling information of query response delivery is informed to the MS in the Cycle TLV of PKM-RSP (Code=32) transmitted to the MS. In case of unicast delivery method, MS shall check whether this IE is included in the UL-MAP of the frame indicated by Cycle TLV. When this IE exists in the UL-MAP, MS sends PKM-REQ (Code=33) message with Query ID TLV which was received from the BS. MS may wait for the delivery of MIH_Polling_IE until predetermined counter, Query Retry Counter, is exhausted.

Table 302z. MIH_Polling_IE

Syntax	Size	Notes
MIH_Polling_IE () {		
Extended UIUC	4bits	MIH_Polling = 0x0B
Length	4bits	
Query ID	16bits	
Duration	10 bits	OFDMA slots for the uplink bandwidth
Reserved		
}		

Remedy 7:

[6.3.25 MIH handover function, page 15, line 51, Add behavior of BS as follows]:
When MIH query capability during network entry is enabled (11.20.2), PKM messages may be used to exchange MIH frame for MIH queries. When broadcast delivery method is chosen for delivery of PKM-RSP (Code=34), BS shall make unsolicited bandwidth allocation at the end of cycle in order for MS to transmit PKM-REQ (Code=33).

Remedy 8:

[6.3.9.8 SS authorization and key exchange, page 15, line 47, modify]:

6.3.9.8 SS authorization and key exchange

If PKM is enabled (see 11.7.8.7), the BS and SS shall perform authorization and key exchange as described in 7.2.
If MIH query capability during network entry is enabled (11.20.2), the BS and MS may perform MIH query

~~using PKM messages before authorization and key exchange.~~