



**WiMAX Forum<sup>®</sup>**  
**Recommendations and Requirements for WiMAX**  
**Messaging Services (WMS)**

**WMF-T31-125-R020v01**

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**WiMAX Forum Proprietary**

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## 1. Introduction (Informative)

This document is the first of a three-stage, end-to-end network system architecture specification for broadband wireless networks based on WiMAX Forum Certified™ products. This document specifies recommendations and requirements for such networks from the perspective of network operators intending to deploy WiMAX® networks. It describes business and usage scenarios, deployment models, functional requirements, and performance guidelines for the end-to-end system. Architecture details shall be specified in stage-2 and stage-3 specifications based on requirements outlined in this document.

## 2. Objective and Scope

The objective of this specification is to define requirements to support messaging services with focus on SMS and MMS delivered over mobile WiMAX. The WiMAX Messaging Service supports WiMAX network and device (e.g. WiMAX Release 1.0 and 1.5) without any air interface change as well as WiMAX Release 2.0 network and device with enhancement to the air interface to transport messages in the 802.16m air interface.

The scope of the specification includes both device and network requirements to provide WiMAX Messaging Service that covers the following areas:

- To define use cases of WMS that support messaging over mobile WiMAX.
- To define requirements of WMS that support messaging on WiMAX network and devices that enable various deployment environments
- To define network requirements for interworking with 3GPP and 3GPP2 for SMS and MMS.
- To define 16m air interface requirement for support of WMS.
- To identify relevant roaming/inter-operator requirements (and associated wholesale rating, clearing and financial statements).

The requirements for short message will be limited to sending texts message and notification of multimedia message and email as fax. Other functions of short message currently in 3GPP or 3GPP2 such as binary container for the over the air activation are out of scope of this requirement document.

Note: For voice call continuity between WiMAX and 3GPP2 networks, short message may be used but it is out of the scope of this document.

WiMAX Messaging Service is an optional feature for the WiMAX system. However, when supported, the requirements defined in this document are applicable to both the devices and the networks.

## 3. Abbreviations, Definitions, and Conventions (Informative)

### 3.1 Conventions (Informative)

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in Ref [302] RFC 2119.

## **3.2 Abbreviations and Acronyms (Informative)**

3GPP – Third Generation Partnership Project  
3GPP2 – Third Generation Partnership Project 2  
ASN – Access Service Network  
CSN – Connectivity Service Network  
GIF – Graphic File Format  
HRPD – High Rate Packet Data  
JPEG – Joint Photographic Experts Group  
MDN – Mobile Directory Number  
MMS – Multimedia Message Service  
MSISDN – Mobile Station International Subscriber Directory Number  
NAI – Network Access Identifier  
SIM – Subscriber Identity Module  
SMS – Short Message Service  
USIM – Universal Subscriber Identity Module  
VAS – Valued Added Service  
WMS – WiMAX Messaging Service

## **3.3 Definitions (Informative)**

### **3.3.1. 3rd Party Messaging Provider**

The 3rd Party Messaging Provider is a service provider that provides interworking between 2 separate service providers (both inter-technology and intra technology).

### **3.3.2. 3GPP Circuit-Switched MS**

A Mobile Station operates in a 3GPP circuit-switched network environment.

### **3.3.3. 3GPP IP MS**

A Mobile Station that operates in a 3GPP packet-switched (i.e., IP) network environment.

### **3.3.4. 3GPP2 Circuit-Switched MS**

A Mobile Station that operates in a 3GPP2 circuit-switched network environment.

### **3.3.5. 3GPP2 IP MS**

A Mobile Station that operates in a 3GPP2 packet-switched (i.e., IP) network environment.

### **3.3.6. Multimedia Message (MM)**

A message that contains one or more media types (e.g., text, audio, video, image, etc.).

### **3.3.7. Multimedia Messaging Service (MMS)**

MMS provides a means of sending/receiving messages that contain one or more media types to/from a Mobile Station in a non-real time fashion.

### **3.3.8. Short Message (SM)**

A text message of limited size (e.g., 140 octets).

### **3.3.9. Short Message Service (SMS)**

SMS provides a means of sending/receiving text messages of limited size, via a store-and-forward mechanism, to/from a Mobile Station.

### **3.3.10. Value Added Service Provider (VASP)**

VASP provides value added services (e.g. Emergency Service, Location Base Service, Mobile Game, Streaming media, Web Browser, etc.) other than basic telecommunications service. VAS Applications may result in generate Accounting Records.

### **3.3.11. WiMAX Messaging Server**

The WiMAX Messaging Server functionalities similar to those in Short Message Service Centre defined in ref 3GPP 23.040 [002].

## **4. References**

### **4.1 3GPP References**

- [001] 3GPP TS 22.105 “Services and service capabilities”.
- [002] 3GPP TS 23.040 “Technical realization of Short Message Service (SMS)”, GSM Phase 2 and beyond.
- [003] 3GPP TS 23.204 “Support of Short Message Service (SMS) over Generic 3GPP Internet Protocol (IP) access; Stage 2, Rel 7 and beyond.
- [004] 3GPP TS 23.048 “Security mechanism for the (U)SIM application toolkit; stage 2”, GSM Phase 2 and beyond.
- [005] 3GPP TS 24.011 “Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface”

### **4.2 3GPP2 References**

- [101] 3GPP2 X.S0048 “Short Message Service Over IMS”, November 2007.
- [102] 3GPP2 S.R0006-601-A “Wireless Features Description: Wireless Messaging Teleservice, July 2007.
- [103] 3GPP2 C.S0015-b “Short Message Service (SMS) for Wideband Spread Spectrum Systems – Release B”.

### **4.3 OMA References**

- [201] Open Mobile Alliance, “Multimedia Messaging Service 1.3”.

### **4.4 WiMAX References**

- [301] SWG-wg00001-v01: SPWG Requirements Development Guidelines.
- [302] RFC 2119 “Key words for use in RFCs to Indicate Requirement Levels”.

## 5. Use Cases (Informative)

### 5.1 Use Case 1 - Messaging within WiMAX Networks (Informative)

#### 5.1.1. Short Description

A WiMAX user, Winston is sending messaging (e.g., Short Messages (SM) or Multimedia Messages (MM)) to Watson, a user of WiMAX service provider network W. Both users can be in the same service provider network or different service provider network. For this use case, same service provider network is assumed.

#### 5.1.2. Actors

**Winston** – WiMAX Network W subscriber.

**Watson** – WiMAX Network W subscriber.

#### 5.1.3. Pre-conditions

Both Winston and Watson have device that support WiMAX Messaging Service. Winston is a subscriber of WiMAX Network W and Watson is a subscriber of WiMAX Network W as well.

#### 5.1.4. Post-conditions

The message originated by Winston was delivered to Watson.

#### 5.1.5. Normal Flow

1. Winston already has his mobile station turned on.
2. Winston decided to send a message (e.g., Short Message or Multimedia Message) to Watson to set up a meeting to discuss project x.
3. After composing the messages, Winston selected Watson from his address book and pressed send button.
4. The network service provider W's WiMAX Messaging Server delivers the message to Watson.
5. Watson receives the message.
6. Watson replied to Winston to confirm participation in the discussion.

#### 5.1.6. Alternative Flow

1. Winston already has his mobile station turned on.
2. Winston decided to send a message to Watson to set up a meeting to discuss project x.
3. After composing the messages, Winston selected Watson from his address book and pressed send button.
4. Watson is not available (e.g., not registered to the network). A messaging awaiting indicator is turn on and will be sent to Watson, when he registers with the network

Note: step 4 is not supported in standardized 3GPP IMS, it's currently support in 3GPP GSM circuit switch system.

## **5.2 Use Case 2 - Short Messaging from WiMAX network to 3GPP/2 Network (Informative)**

### **5.2.1. Short Description**

A user of WiMAX Network W, Winston is sending a Short Message to Carl a subscriber of Cellular Network C that utilizes cellular technology (e.g. CDMA or GSM technology). They can be in the same service provider or different service providers.

### **5.2.2. Actors**

**Winston** – WiMAX Network W subscriber.

**Carl** – Cellular Network C subscriber.

### **5.2.3. Pre-conditions**

Both Winston and Carl have device that support Short Message Service. Winston is a subscriber of WiMAX Network W and Carl is a subscriber of Cellular Network C.

### **5.2.4. Post-conditions**

The Short Message originated by Winston was delivered to Carl.

### **5.2.5. Normal Flow**

1. Winston already has his mobile station turned on.
2. Winston decided to send a Short Message to Carl to set up a meeting to discuss project x.
3. After composing the Short Message, Winston selected Carl from his address book and pressed send button. Note: selection of target user can occur before composing of messages.
4. The Short Message was sent from Winston device to his network short messaging interworking entity (e.g., WiMAX Messaging Server) to determine the route to deliver the short message to Carl. Note: Sometimes a 3<sup>rd</sup> Party Messaging Provider is used to provide interworking.
5. Carl's network messaging interworking entity delivers the message per the provider policy and user device capability.
6. Carl received the message.
7. Carl replied to Winston to confirm participation in the discussion.

### **5.2.6. Alternative Flow**

1. Winston already has his mobile station turned on.
2. Winston decided to send a Short Message to Carl to set up a meeting to discuss project x.
3. After composing the Short Message, Winston selected Carl from his book and pressed send button. Note: selection of target user can occur before composing of messages.
4. The Short Message was sent from Winston device to his network short messaging interworking entity (e.g., WiMAX Messaging Server) to determine the route to deliver the short message to Carl.
5. Carl's network messaging interworking entity delivers the message per the provider policy and user device capability.
6. An error may return to Winston network, indicates failure of delivering message.

Note: There may be different interworking solution in 3GPP and 3GPP2. In 3GPP2 there is no standardized mechanism on delivery failure notification. In 3GPP there is an option to use SM delivery option to notify short message center of message failure, pending on the capability in the network and device.

### **5.3 Use Case 3 - Short Messaging from 3GPP/2 network to WiMAX Network (Informative)**

#### **5.3.1. Short Description**

A user of Cellular Network C, that utilizes cellular technology (e.g. CDMA or GSM technology), Carl is sending a Short Message to Winston a subscriber of WiMAX Network W. They can be in the same service provider or different service providers.

#### **5.3.2. Actors**

**Winston** – WiMAX Network W subscriber.

**Carl** – Cellular Network C subscriber.

#### **5.3.3. Pre-conditions**

Both Winston and Carl have device that support Short Message Service. Winston is a subscriber of WiMAX Network W and Carl is a subscriber of Cellular Network C.

#### **5.3.4. Post-conditions**

The Short Message originated by Carl was delivered to Winston.

#### **5.3.5. Normal Flow**

1. Carl already has his mobile station turned on.
2. Carl decided to send a Short Message to Winston to set up a meeting to discuss project x.
3. After composing the Short Message, Carl selected Winston from his address book and pressed send button. Note: selection of target user can occur before composing of messages.
4. The Short Message was sent from Carl device to his network short messaging interworking entity to determine the route to deliver the short message to Winston. Note: Sometimes a 3<sup>rd</sup> Party Messaging Provider is used to provide interworking.
5. Winston's network messaging interworking entity delivers the message per the provider policy and user device capability.
6. Winston received the message.

#### **5.3.6. Alternative Flow**

1. Carl already has his mobile station turned on.
2. Carl decided to send a Short Message to Winston to set up a meeting to discuss project x.
3. After composing the Short Message, Carl selected Winston from his address book and pressed send button. Note: selection of target user can occur before composing of messages
4. The Short Message was sent from Carl device to his network short messaging interworking entity (e.g., WiMAX Messaging Server) to determine the route to deliver the short message to Winston

5. Winston's network messaging interworking entity delivers the message per the provider policy and user device capability.
6. An error may return to Carl's network, indicates failure of delivering message

## **5.4 Use Case 4 - Multimedia Messaging from 3GPP/2 network to WiMAX Network (Informative)**

### **5.4.1. Short Description**

A user of Cellular Network C, that utilizes cellular technology (e.g. CDMA or GSM technology), Carl is sending a Multimedia Message to Winston a subscriber of WiMAX Network W. They can be in the same service provider or different service providers.

### **5.4.2. Actors**

**Winston** – WiMAX Network W subscriber.

**Carl** – Cellular Network C subscriber.

### **5.4.3. Pre-conditions**

Both Winston and Carl have device that support Multimedia Message Service. Winston is a subscriber of WiMAX Network W and Carl is a subscriber of Cellular Network C.

### **5.4.4. Post-conditions**

The Multimedia Message originated by Carl (Cellular Network C's subscriber) was delivered to Winston (WiMAX Network W's subscriber).

### **5.4.5. Normal Flow**

1. Carl already has his mobile station turned on.
2. Carl decided to send a photo via Multimedia Message Service to Winston regarding project x.
3. After composing the Multimedia Message, Carl selected Winston from his address book and pressed send button. Note: selection of target user can occur before composing of messages.
4. The Multimedia Message was sent from Carl device to the Carl's Cellular Network Multimedia Message Service Center (CMMSC).
5. Carl's CMMSC determines Winston is in different service provider, the CMMSC forwards the message to Winston's WiMAX Message Server for multimedia message to be delivered to Winston.
6. Winston's WiMAX Message Server delivers the message to Winston.

Note: A 3<sup>rd</sup> Party Messaging Provider maybe involve due to the different message formats with more than one messaging servers...

### **5.4.6. Alternative Flow**

1. Carl already has his mobile station turned on.
1. Carl decided to send a photo via Multimedia Message Service to Winston regarding project x.

2. After composing the Multimedia Message, Carl selected Winston from his address book and pressed send button. Note: selection of target user can occur before composing of messages.
3. The Multimedia Message was sent from Carl device to the Carol's Cellular Network Multimedia Message Service Centre (CMMSC).
4. Carl's CMMSC determines Winston is in different service provider, the CMMSC forward the message to Winton's WiMAX Message Server for Multimedia Message to be delivered to Winston.
5. An error may return to Carl's network indicates failure of delivering message.

Note: A 3<sup>rd</sup> Party Messaging Provider maybe involve due to the different message formats with more than one messaging servers.

## **5.5 Use Case 5 - Multimedia Messaging from WiMAX network to 3GPP/2 Network (Informative)**

### **5.5.1. Short Description**

A user of WiMAX Network W, Winston is sending a Multimedia Message to a subscriber of Cellular Network C that utilizes cellular technology (e.g. CDMA or GSM technology), Carl. They can be in the same service provider or different service providers.

### **5.5.2. Actors**

**Winston** – WiMAX Network W subscriber.

**Carl** – Cellular Network C subscriber.

### **5.5.3. Pre-conditions**

Both Winston and Carl have device that support Multimedia Message Service. Winston is a subscriber of WiMAX Network W and Carol is a subscriber of Cellular Network C.

### **5.5.4. Post-conditions**

The Multimedia Message originated by Winston was delivered to Carl.

### **5.5.5. Normal Flow**

1. Winston already has his mobile station turned on.
2. Winston decided to send a photo via Multimedia Message service to Carl regarding project x.
3. After composing the Multimedia Message, Winston selected Carl from his address book and pressed send button. Note: selection of target user can occur before composing of messages.
4. The Multimedia Message was sent from Winston device to his WiMAX Message Server to determine the route to deliver the Multimedia Message to Carl.
5. The message was delivered to Carls Cellular Network Multimedia Messaging Service Center (CMMSC).
6. Carl's Cellular Network Multimedia Messaging Service Center (CMMSC) delivers the Multimedia Message per the provider policy and user device capability.
7. Carl received the message.

Note: A 3<sup>rd</sup> Party Messaging Provider maybe involve due to the different message formats with more than one messaging servers.

### 5.5.6. Alternative Flow

1. Winston already has his mobile station turned on.
2. Winston decided to send a photo via Multimedia Message Service to Carl regarding project x.
3. After composing the Multimedia Message, Winston selected Carl from his address book and pressed send button. Note: selection of target user can occur before composing of messages.
4. The Multimedia Message was sent from Winston device to his WiMAX Message Server to determine the route to deliver the Multimedia Message to Carl
5. Carl's Cellular Network Multimedia Messaging Service Centre (CMMSC) delivers the Multimedia Message per the provider policy and user device capability.
6. In case the delivery failed, a notification may return to Winston's WiMAX Messaging Server indicates failure (e.g., Carl is not available and the message has expired) of delivering message. If supported by the originating network, the notification will be forwarded to the subscriber, Winston.

## 6. Deployment/Interworking scenarios (*Informative*)

### 6.1 *Interworking with 3GPP over IMS*

#### 6.1.1. General

The System Requirements in section 7.1 specify interworking with 3GPP and 3GPP2 Short Message Service in the 3GPP/2 circuit switch network and IP network. Many statistics have shown majority of the short messages are still been transported over circuits switch network with the anticipation to grow more user in the IP network. Therefore, it is necessary to support various interworking scenarios. Below are the possible scenarios:

- WiMAX Originating Short Message to 3GPP Intra carrier networks; see section 6.1.2 for detail.
- WiMAX Originating Short Message to 3GPP Inter carrier networks; see section 6.1.3 for detail.
- 3GPP Originating Short Message to WiMAX network Inter carrier networks, see section 6.1.4 for detail

All the sub-sections assume the subscriber already has service subscription and has performed necessary network discovery and authentication prior to initiating short message.

The deployment scenarios illustration in section 6.1 assume IMS is deployed in both 3GPP and WiMAX network, hence normal IMS routing for message delivery is performed. However, when IMS is not deployed in 3GPP, it is assumed message interworking function is needed.

For interworking with 3GPP or between WiMAX service providers, a 3<sup>rd</sup> party Messaging Provider is often used for valued added service (e.g., charging settlement, content conversion, routing selection).

#### 6.1.2. WiMAX® Originating Short Message to 3GPP Intra carrier networks

One of the possible deployment scenarios is a service provider that has both WiMAX and a cellular network (i.e., 3GPP). For this implementation, it is desirable to reuse common platform or network entities. In figure 1, the common platform is IMS for both 3GPP and WiMAX networks. Hence, it illustrated IMS based SMS over IP solution, which introduces a new entity called IP-SM-GW. In the figure, it is assumed there will be no change in the 3GPP cellular network and the target user can be in circuit switch (CS) network or package switch (PS) network. The IP-SM-GW will determine the destination network (PS or CS).

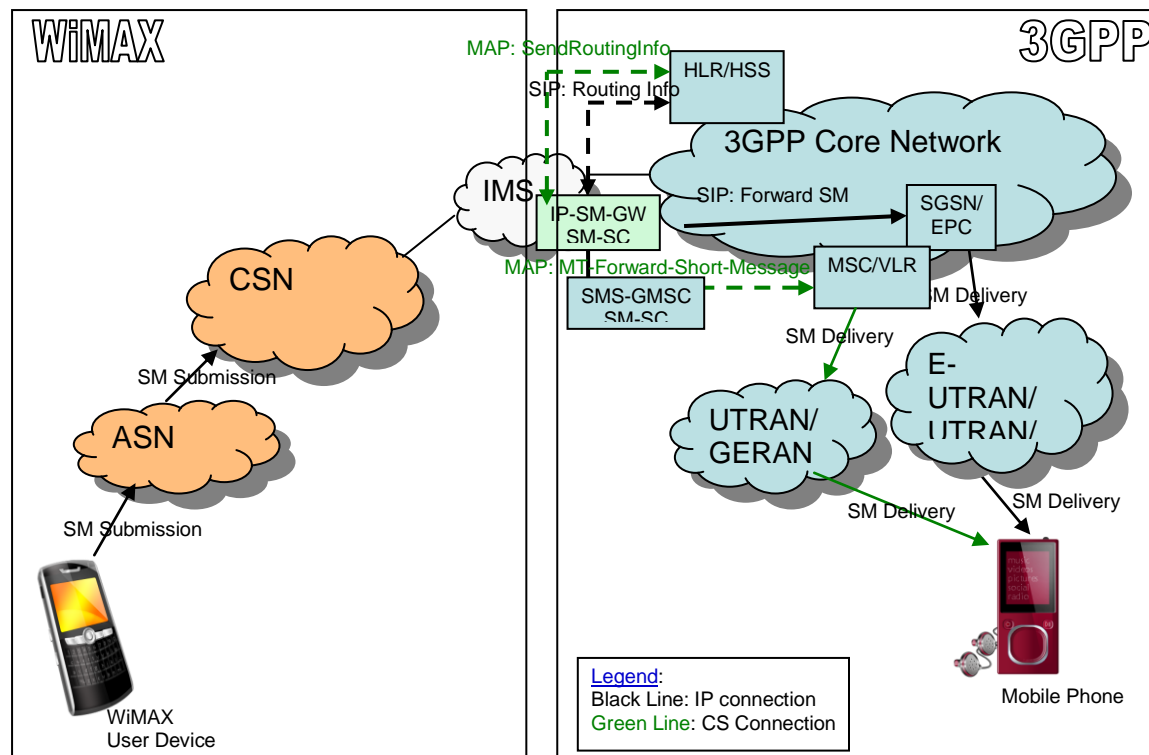


Figure 1: WiMAX originating Short Message terminating in 3GPP Intra network

### 6.1.3. WiMAX® Originating Short Message to 3GPP Inter carrier networks

One possible deployment scenario for a WiMAX service provider is to have service agreement with 3GPP partner. For this implementation, it is desirable to reuse common platform or network entities. In figure 2, the common platform is IMS for both 3GPP and WiMAX networks. Hence, it illustrated IMS based SMS over IP solution with a new entity called IP-SMS-GW. This IP-SMS-GW may have direct connection to SM-SC. However, the interface between IP-SMS-GW and SM-SC is not specified. In this particular example, the WiMAX subscriber initiates a short message, the possible procedures are:

1. WiMAX IMS subscriber initiates a Short Message to a 3GPP recipient.
2. Short Message arrives at WiMAX subscriber's Network (e.g., IP-SMS-GW over IMS).
3. WiMAX Network (e.g., IP-SMS-GW) determines if the recipient is its WiMAX subscriber, when it concludes it's not; it determines the recipient user's serving network and forwards the message to it.
4. The recipient serving network (e.g., 3GPP) determines which domain the subscriber is registered (e.g. circuit switch or packet switch).
5. The recipient serving network delivers the message to the recipient.

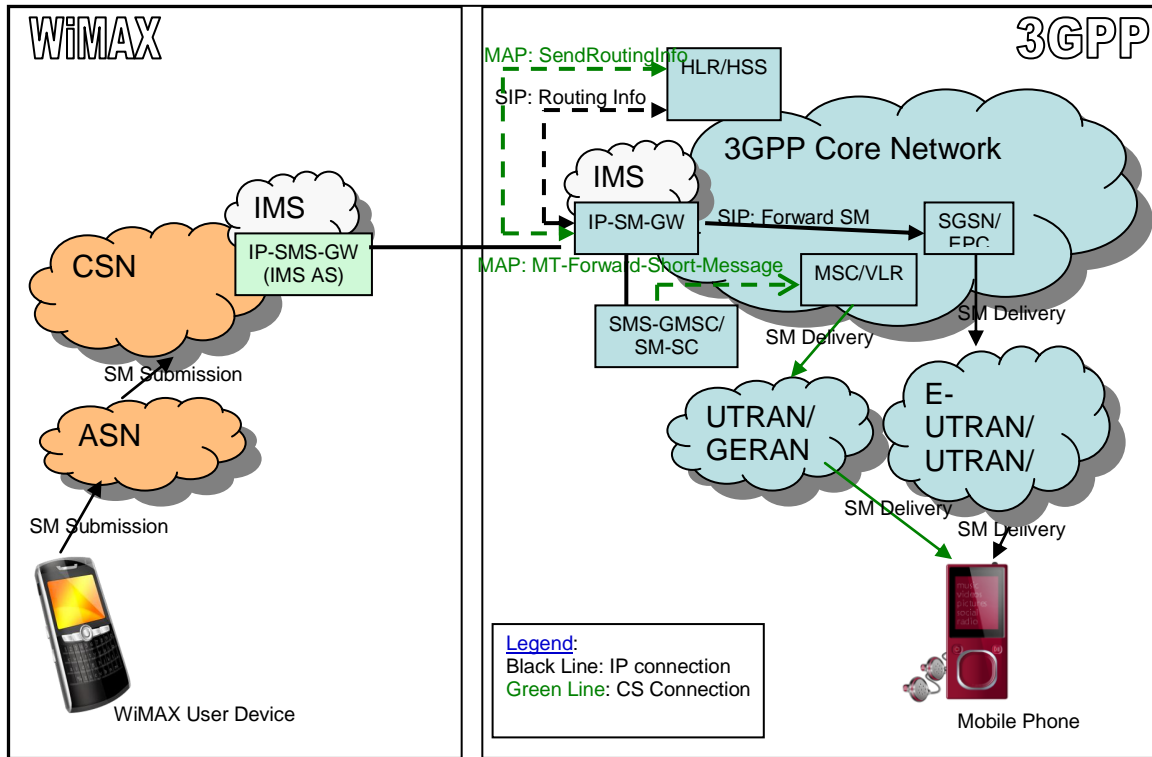


Figure 2: WiMAX Originating Short Message to 3GPP Inter carrier networks

#### 6.1.4. 3GPP Originating Short Message to WiMAX Inter carrier networks

When WiMAX network deployed Short Message Service, there is possibility it's subscriber will receive Short Message from non WiMAX user, e.g., 3GPP cellular user. Figure 3 illustrates an example of 3GPP subscriber originates a Short Message to a WiMAX subscriber. Again the common platform is IMS for both 3GPP and WiMAX networks. Hence, it shows IMS based SMS over IP solution with a new entity called IP-SMS-GW. This IP-SMS-GW may have direct connection to SM-SC. However, the interface between IP-SMS-GW and SM-SC is not specified. In this particular example, the 3GPP subscriber initiates a Short Message, the possible procedures are:

1. 3GPP IMS subscriber initiates Short Message to a WiMAX recipient.
2. Short Message arrives at 3GPP subscriber's Network (e.g. IP-SM-GW with SM-SC over IMS),
3. 3GPP Network determines if the recipient is its subscriber, when it concludes it's not, it determines the recipient user's serving network and forwards the message to WiMAX IP-SM-GW.
4. The recipient serving network (e.g., WiMAX IP-SMS-GW) receives the message and delivers it to the recipient.

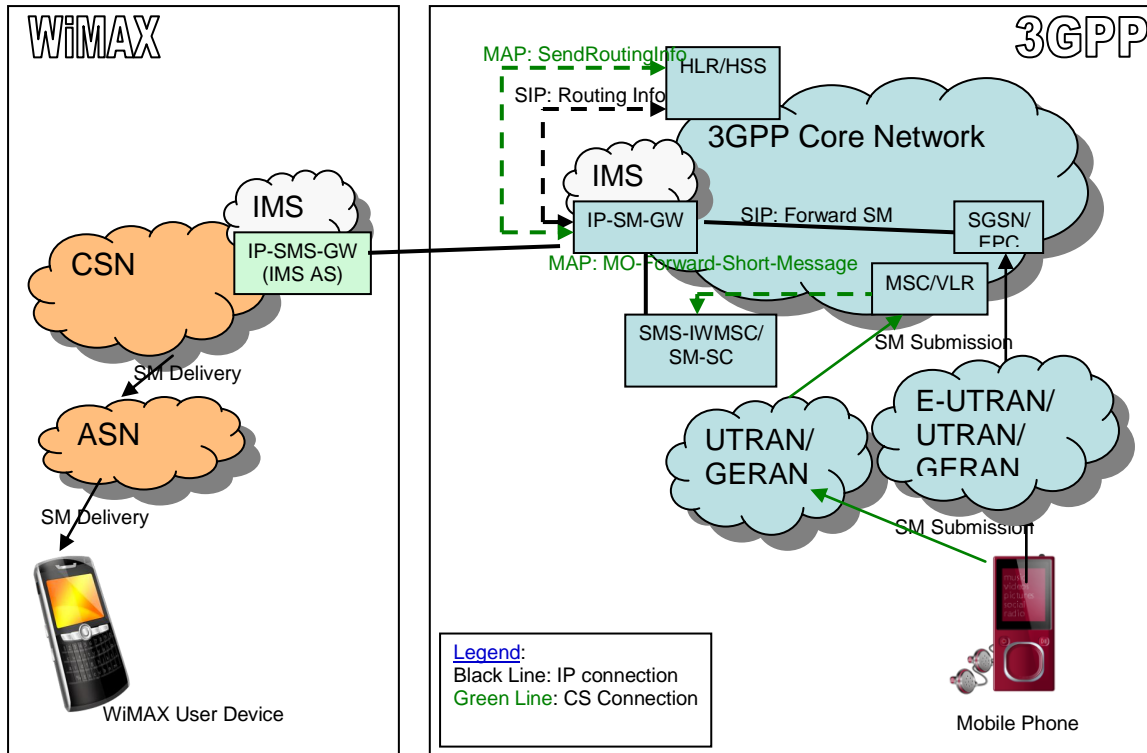


Figure 3: 3GPP Originating Short Message to WiMAX network Inter carrier networks

### 6.1.5. Conclusion on Interwork with 3GPP network

There are many possible solutions to fulfill the requirements in section 7.1 for interworking with 3GPP IP network; however, 3GPP already standardized their Short Message Service over non-cellular IP Connectivity Access Network in 3GPP TS 23.204 since their release 7.0 published in October 2006. Their solution is based on their IP Multimedia Subsystem design principle that utilizes IETF Session Initiation Protocol (SIP) as defined in RFC 3261. Reusing this design principle for WiMAX network has many advantages, such as:

- Does not require modification to IEEE 802.16e standard or WiMAX system profile Rel 1.0,
- Compatible with 3GPP IP network,
- Design with same IMS architecture solution in both WiMAX and 3GPP,
- Use common protocol (i.e., SIP) in both WiMAX and 3GPP,
- Utilize application layer solution that is access independent.

## 6.2 Interworking with 3GPP2 over IMS

### 6.2.1. General

The System Requirements in section 7.1 specified interworking with 3GPP2 Short Messaging Service in the 3GPP2 circuit switch network and IP network. Many statistics have shown majority of the short messages are still been transport over circuits switch network with the anticipation to grow more user in the IP network. Therefore, it is necessary to support various interworking scenarios. Below are the possible scenarios:

- WiMAX Originating Short Message to 3GPP2 Intra carrier networks; see section 6.2.2 for detail.

- WiMAX Originating Short Message to 3GPP2 Inter carrier networks; see section 6.2.3 for detail.
- 3GPP2 Originating Short Message to WiMAX network Inter carrier networks, see section 6.2.4 for detail

All the sub-sections assumed the subscriber already has service subscription and has performed necessary network discovery and authentication prior to initiating short message.

The deployment scenarios illustration in section 6.2 assumed IMS is deployed in both 3GPP2 and WiMAX network, hence normal IMS routing for message delivery is performed. However, when IMS is not deployed in 3GPP2, it is assumed message interworking function is needed.

For interworking with 3GPP2 or between WiMAX service providers, a 3<sup>rd</sup> party Messaging Provider is often used for valued added service (e.g., charging settlement, content conversion, routing selection).

Note 1: The reference of MAP is used in the figures as illustration based on 3GPP2 X.S0004; regional specific reference names will need to be used for adjustment during implementation.

### 6.2.2. WiMAX Originating Short Message to 3GPP2 Intra carrier networks

One of the possible deployment scenarios is a service provider that has both WiMAX and a cellular network (i.e., 3GPP2). For this implementation, it is desirable to reuse common platform or network entities. In figure 4, the common platform is IMS for both 3GPP2 and WiMAX networks. Hence, it illustrated IMS based SMS over IP solution, which introduces a new entity called SMS-GW/MC. In the figure, it is assumed there will be no change in the 3GPP2 cellular network and the target user can be in circuit switch (CS) network or package switch (PS) network. The determination of which network to delivery the message is at the SMS-GW/MC.

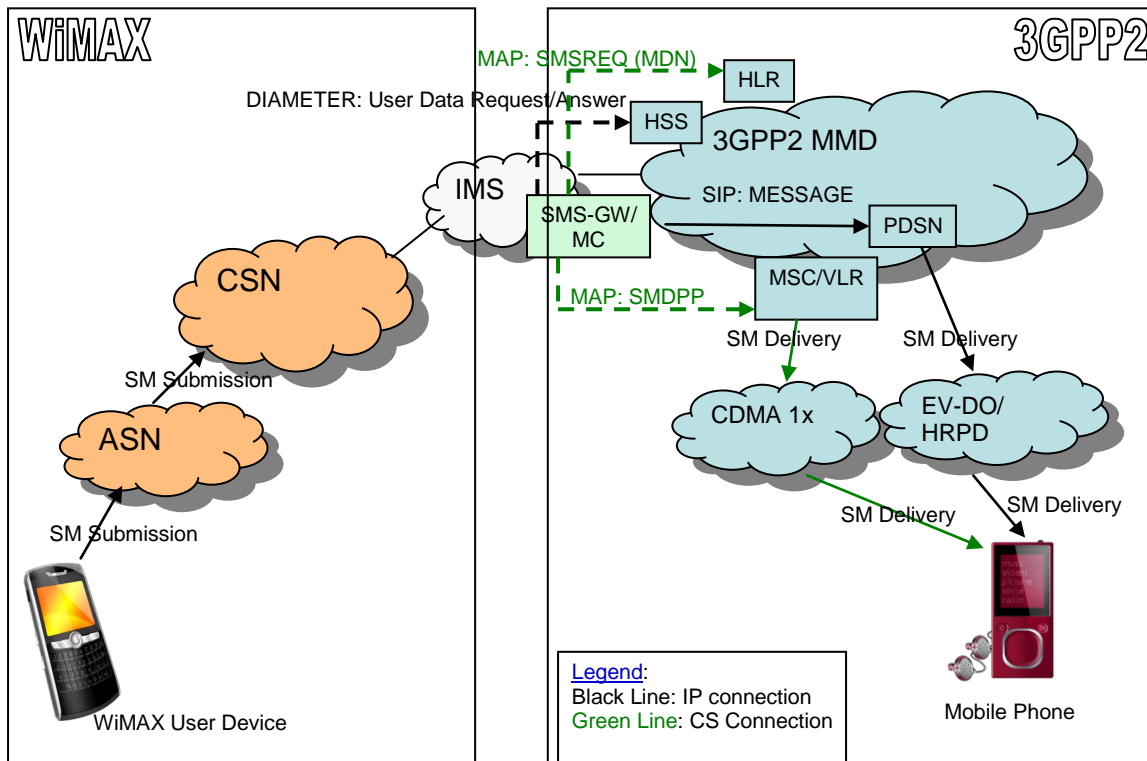


Figure 4: WiMAX originating Short Message terminating in 3GPP2 Intra network

### 6.2.3. WiMAX Originating Short Message to 3GPP2 Inter carrier networks

One possible deployment scenario for a WiMAX service provider is to have service agreement with cellular partners (i.e., 3GPP2). For this implementation, it is desirable to reuse common platform or network entities. In figure 5, the common platform is IMS for both 3GPP2 and WiMAX networks. Hence, it illustrated IMS based SMS over IP solution. In this particular example, the WiMAX subscriber initiates a short message, the possible procedures are:

1. WiMAX IMS subscriber initiates a Short Message to a 3GPP2 recipient.
2. Short Message arrives at WiMAX subscriber's Network (e.g., IP-SMS-GW).
3. The IP-SMS-GW in WiMAX Network determines if the recipient is its WiMAX subscriber, when it concludes it's not, it determines the recipient user's serving network and forwards the message to SMS-GW/MC in 3GPP2 network.
4. The recipient serving network (e.g., MC/SMS-GW determines which domain the message needs to be forwarded to CS or IMS).
5. The recipient serving network (e.g., 3GPP2) delivers the message to the recipient.

For this deployment scenario, the working assumption is no impact to the 3GPP2 short message delivery mechanism from WiMAX network; standardized 3GPP2 short message delivery procedures are executed. The access technology of the recipient is transparent to the originating user. For the WiMAX network, a new IP-SMS-GW is introduced. IP-SMS-GW can be considered as an IMS application server with internal interface to SMS service center.

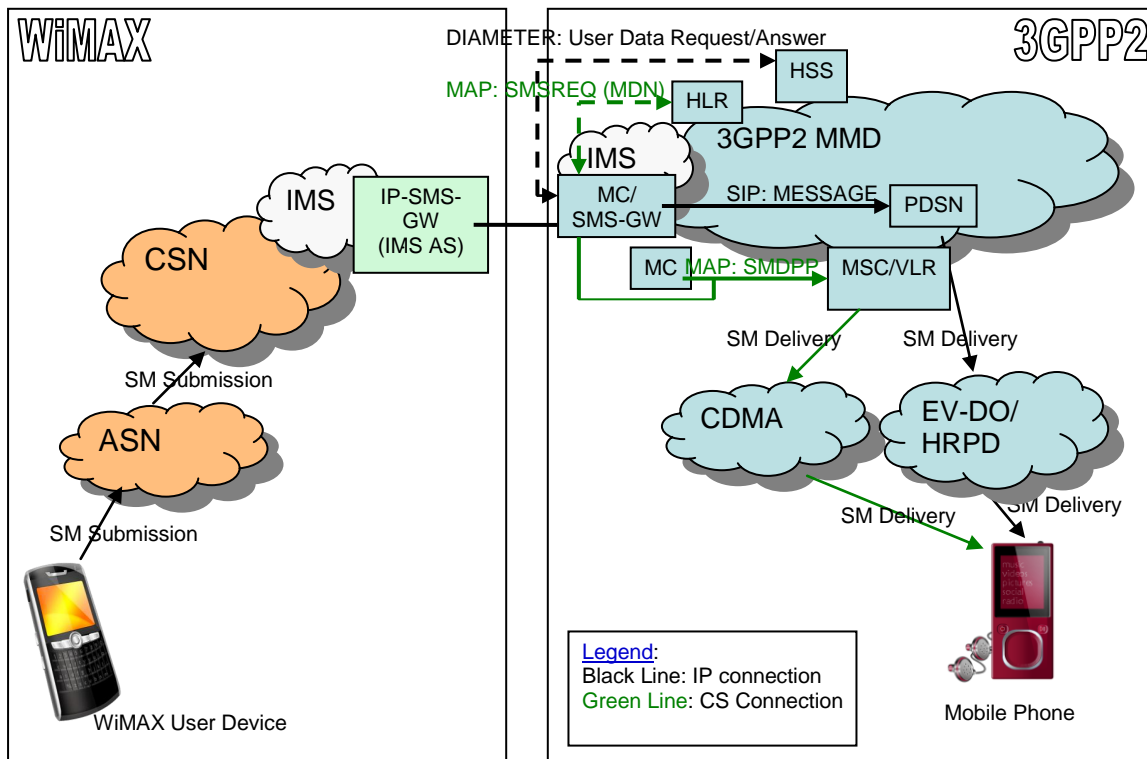


Figure 5: WiMAX Originating Short Message to 3GPP2 Inter carrier networks

### 6.2.4. 3GPP2 Originating Short Message to WiMAX Inter carrier networks

When a WiMAX network deploys Short Message Service, there is the possibility that a WiMAX subscriber will receive a Short Message from a non WiMAX user, e.g., 3GPP2 cellular user. Figure 6 illustrates an example of a 3GPP2 subscriber which originates a Short Message to a WiMAX subscriber. Again, the common platform is IMS for both 3GPP2 and WiMAX networks. Hence, it illustrates IMS based SMS over IP solution. In this particular example, the 3GPP2 subscriber initiates a Short Message. The possible procedures are:

1. 3GPP2 IMS subscriber initiates Short Message to a WiMAX recipient.
2. Short Message arrives at 3GPP2 subscriber's Network (e.g. SMS-GW/MC over IMS).
3. The 3GPP2 MC/SMS-GW determines if the recipient is its subscriber, when it concludes it's not, it determines the recipient user's serving network and forwards the message to WiMAX IP-SMS-GW.
4. The recipient serving network (e.g., WiMAX IP-SMS-GW) receives the message and delivers the message to the recipient.

For this deployment scenario, the working assumption is no impact to the 3GPP2 Network to support short message delivery to WiMAX network. The access technology of the recipient is transparent to the originating user. For the WiMAX network, a new IP-SMS-GW is introduced. IP-SMS-GW can be considered as an IMS application server with internal interface to SMS service center.

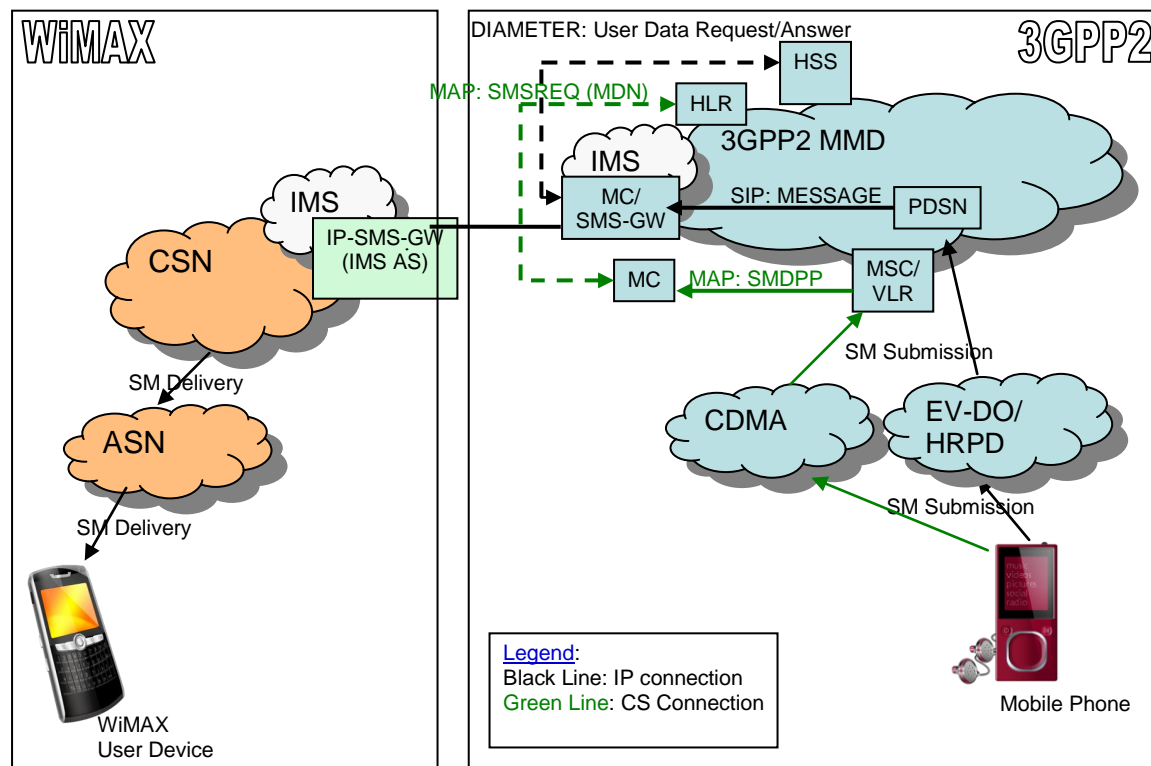


Figure 6: 3GPP2 Originating Short Message to WiMAX network Inter carrier networks

### **6.2.5. Conclusion on Interwork with 3GPP2 network**

There are many possible solutions to fulfill the requirements in section 7.1 for interworking with 3GPP2 IP network; however, 3GPP2 already standardized their Short Message Service over non-cellular IP Connectivity Access Network in 3GPP2 X.S0048 published in November 2007. Their solution is based on their IP Multimedia Subsystem design principle that utilizes IETF Session Initiation Protocol (SIP) as defined in RFC 3261. Reusing this design principle for WiMAX network has many advantages, such as:

- Does not require modification to IEEE 802.16e standard or WiMAX system profile Rel 1.0,
- Compatible with 3GPP2 IP network,
- Design with same IMS architecture solution in both WiMAX and 3GPP2,
- Use common protocol (i.e., SIP) in both WiMAX and 3GPP2,
- Utilize application layer solution that is access independent.

## **6.3 Short Message deployment scenarios for WiMAX Network over IMS**

### **6.3.1. General**

The System Requirements in section 7.1 specified requirements for WiMAX user to originate Short Message and terminate the Short Message within the same serving WiMAX System. Below are the possible scenarios:

- WiMAX Originating Short Message terminating within it's network; see section 6.3.2 for detail.
- WiMAX Originating Short Message terminating to another WiMAX network; see section 6.3.3 for detail.

The following working assumptions were applied:

- The subscriber already has service subscription and has performed necessary network discovery and authentication prior to initiating short message.
- The device is SMS capable.

### **6.3.2. WiMAX Originating Short Message to same network delivery - Intra carrier network**

For this deployment scenario it assumes the originating user and recipient are served by the same service provider network. In figure 7, the IMS based SMS over IP solution is illustrated. In this deployment, a new entity called IP-SMS-GW is introduced. IP-SMS-GW can be considered as an IMS application server with internal interface to SMS service center. In this particular example, the WiMAX user 1 initiates a short message to WiMAX user 2, the procedures are:

1. WiMAX User 1 initiates a Short Message to WiMAX user 2.
2. Short Message arrives at WiMAX User 1 Network (e.g., IP-SMS-GW).
3. The IP-SMS-GW delivers the message to the recipient.

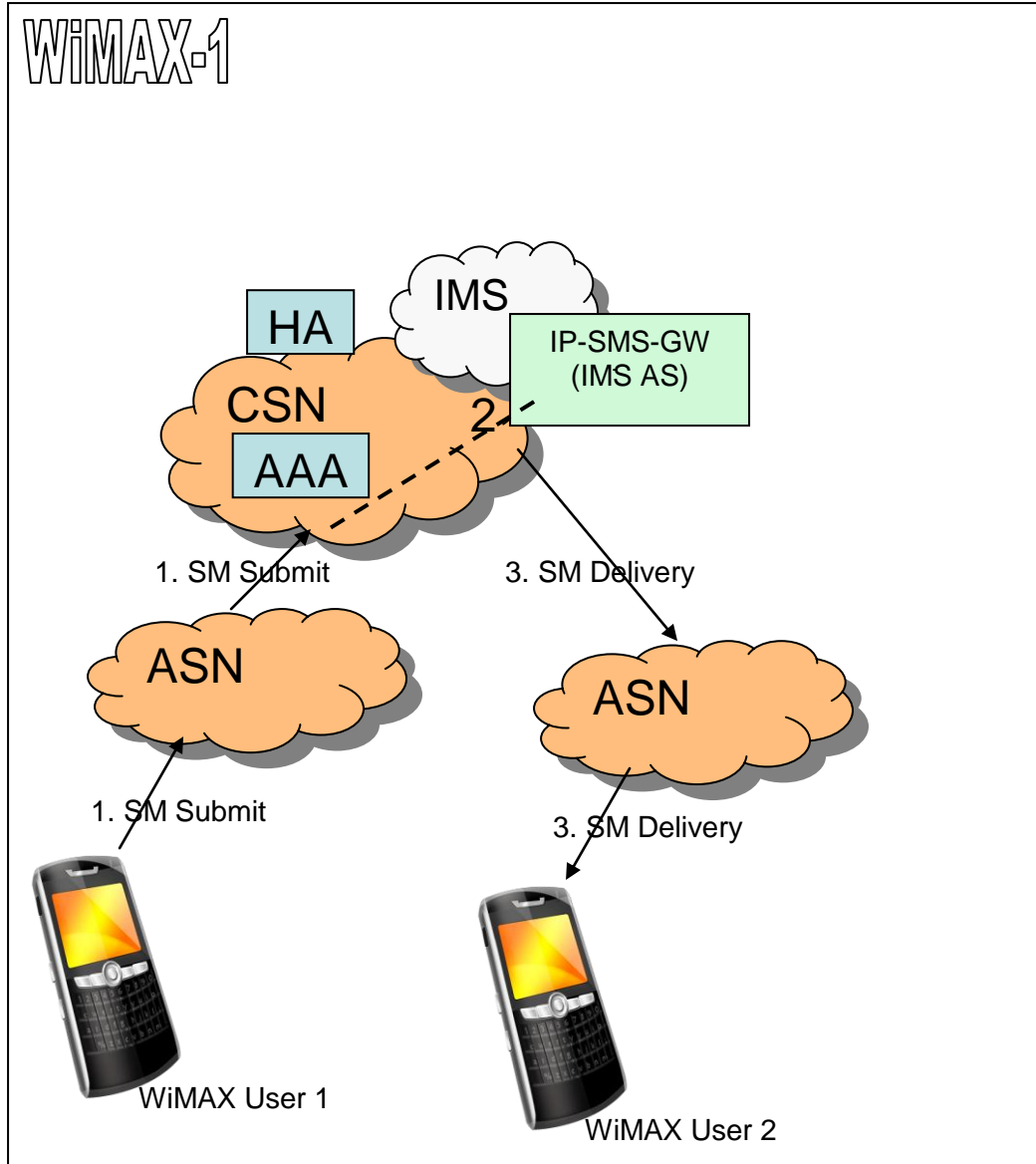


Figure 7: WiMAX originating Short Message terminating in same network

### 6.3.3. WiMAX Originating Short Message to different WiMAX network - Inter carrier networks

For this deployment scenario it assumes the originating user and recipient are served by different service provider networks. In figure 8, the IMS based SMS over IP solution is illustrated. In this deployment, a new entity called IP-SMS-GW is introduced. IP-SMS-GW can be considered as an IMS application server with internal interface to SMS service center. In this particular example, the WiMAX user 1 initiates a Short Message to WiMAX user 2, the procedures are:

1. WiMAX user 1 initiates Short Message to a WiMAX user 2.

2. Short Message arrives at WiMAX -1 Network (e.g., IP-SMS-GW).
3. WiMAX-1 Network determines if the recipient is its subscriber, when it concludes it's not, it determines the serving network of the recipient and forwards the message to the recipient's network..
4. The IP-SMS-GW in WiMAX-2 network receives the message and delivers it to the recipient.

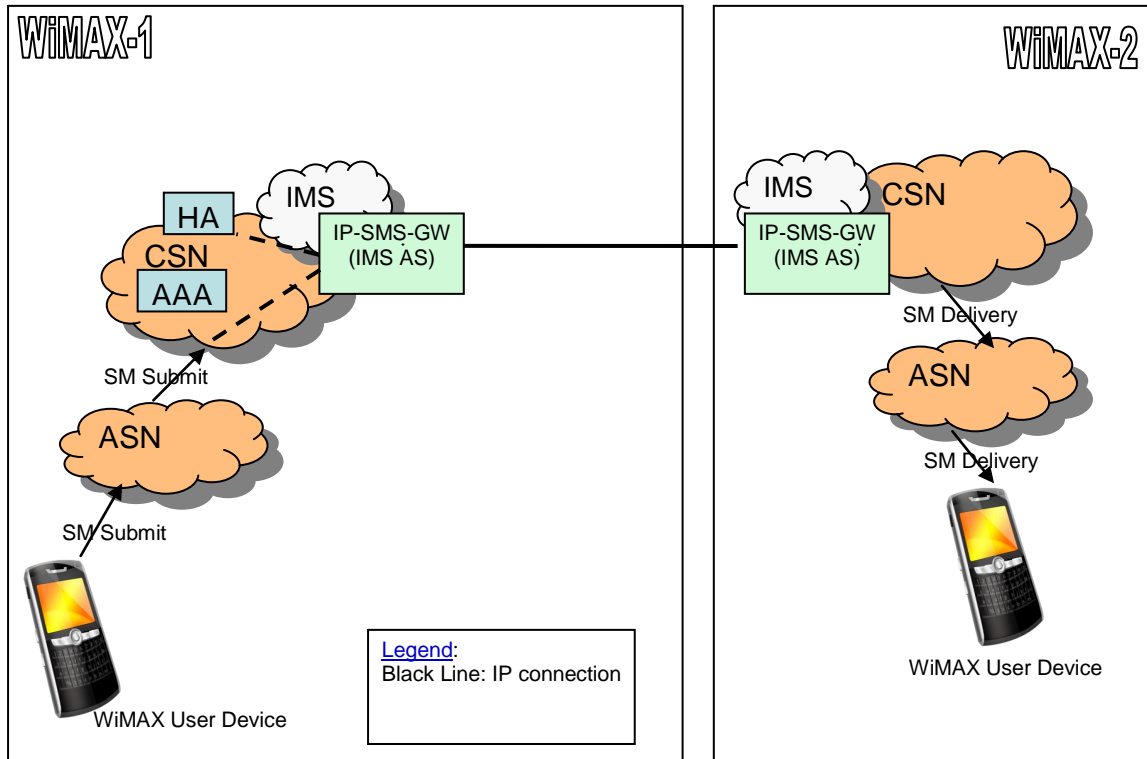


Figure 8: WiMAX-1 originating Short Message terminating in WiMAX-2

## 7. Requirements (Conditional Normative)

WiMAX® Messaging Service is an optional feature for the WiMAX system. However, when supported, the requirements defined in this section are applicable to both the devices and the networks.

### 7.1 System Requirements

The system requirements are intended to cover not only WiMAX-to-WiMAX based SMS/MMS, but also interworking/roaming of WiMAX SMS/MMS with those offered by non-WiMAX networks, i.e., 3GPP and 3GPP2.

#### 7.1.1. SMS System Requirements

R-[001] The WiMAX System SHALL support WiMAX MS-originated and WiMAX MS- terminated Short Message (SM).

R-[002] The WiMAX System MAY support service provider initiated point to multiple points (i.e., cell broadcast) SM.

R-[003] The WiMAX System SHOULD support WiMAX MS-originated SM which terminates in a 3GPP Circuit-Switched MS.

R-[004] The WiMAX System SHALL support WiMAX MS-originated SM which terminates in a 3GPP IP MS.

R-[005] The WiMAX System SHOULD support WiMAX MS-originated SM which terminates in a 3GPP2 Circuit-Switched MS.

R-[006] The WiMAX System SHALL support WiMAX MS-originated SM which terminates in a 3GPP2 IP (e.g., HRPD) MS.

R-[007] The WiMAX System SHOULD support 3GPP Circuit-Switched MS-originated SM which terminates in a WiMAX MS.

R-[008] The WiMAX System SHALL support 3GPP IP MS-originated SM which terminates in a WiMAX MS.

R-[009] The WiMAX System SHOULD support 3GPP2 Circuit-Switched MS-originated SM which terminates in a WiMAX MS.

R-[010] The WiMAX System SHALL support 3GPP2 IP MS-originated SM which terminates in a WiMAX MS.

R-[011] The WiMAX Network SHALL support Short Message encoded in any language.

R-[012] The messaging service architecture SHALL enable a 3<sup>rd</sup> party messaging service provider be used to facilitate charging, routing and content conversion or other services. Note: It is the service provider decision to utilize a 3<sup>rd</sup> party messaging provider.

#### 7.1.2. MMS System Requirements

R-[013] The WiMAX System SHALL support WiMAX MS-originated and WiMAX MS-terminated Multimedia Message (MM).

R-[014] The WiMAX System SHALL support WiMAX MS-originated MM which terminates in a 3GPP IP MS.

R-[015] The WiMAX System SHALL support WiMAX MS-originated MM which terminates in a 3GPP2 IP MS.

R-[016] The WiMAX System SHALL support 3GPP IP MS-originated MM which terminates in a WiMAX MS.

R-[017] The WiMAX System SHALL support 3GPP2 IP MS-originated MM which terminates in a WiMAX MS.

R-[018] The WiMAX Network SHALL support Multimedia Message encoded in any language.

R-[019] The WiMAX System SHALL allow MMS user to manage his/her profile. Note: The user profile includes the user-level black list, configuration of MM storage either network based or device based.

R-[020] The WiMAX system SHALL be able to support a request for Multimedia Message to be automatically delivered to the recipient user device (i.e., MM push mechanism), if provided by the service provider and selected by the subscriber.

R-[021] The WiMAX system SHALL be able to support a request for Multimedia Message to be delivered to the recipient's user device on request by the recipient (i.e., MM pull mechanism).

R-[022] The WiMAX system SHALL support streaming for MM delivery from the MMS system to the WiMAX MS.

R-[023] The WiMAX Messaging system SHALL support Multimedia Message to be submitted from a VASP.

R-[024] The WiMAX Messaging system SHALL support Multimedia Message to be delivered to a VASP.

R-[025] The WiMAX Messaging system SHALL support media synchronization /sequencing in case where Multimedia Message is composed of multi-media (e.g., voice and video).

R-[026] The WiMAX messaging system SHOULD support a request to convert between media types (e.g., Fax to image).

R-[027] The WiMAX messaging system SHOULD support a request to convert between media formats (e.g., JPEG to GIF).

## **7.2 High-Level Functional Requirements**

### **7.2.1 Network Requirements**

R-[028] The WiMAX Network SHALL support procedures that interwork with the 3GPP protocol used for circuit switch messaging (i.e., GSM MAP).

R-[029] The WiMAX Network SHALL support procedures that interwork with the 3GPP2 protocol used for circuit switch messaging (i.e. IS-41 MAP).

R-[030] The WiMAX Network that supports IP Multimedia Subsystem (IMS) messaging solution SHALL use 3GPP2 and/or 3GPP short message over IP design principle, such as utilizing Short Messaging over IP as specified in 3GPP TS 23.204 ref [003], 3GPP2 X.S0048 ref [101].

R-[031] The WiMAX Messaging Server and the User Device SHOULD support delivery reporting events similar to 3GPP TS 23.040 ref [002] and 3GPP2.C.S0015-b ref [103]. Note: this is similar to the 3GPP SMS-Deliver Report or SMS-Submit Report.

R-[032] The WiMAX Messaging Server SHALL support the basic SM functionality (e.g., validity-period, service-center-time-stamp, delivery of priority or non-priority message) similar to 3GPP TS 23.040 ref [002], 3GPP2 C.S0015-b ref [103].

R-[033] For a given encoding, the WiMAX SM text size SHALL be the equivalent to either one of the industry specifications, e.g., 3GPP or 3GPP2. For example, the maximum text size in 3GPP is 140 bytes.

R-[034] The WiMAX Network SHALL be able to support an ITU T. International E-164 telephone number for a WiMAX subscriber when interworking with 3GPP or 3GPP2 network.

R-[035] The WiMAX Network SHALL allow the service provider to configure the maximum time of the message to be stored in the WiMAX Messaging Server in case a short message was not delivered to the receiver.

R-[036] The WiMAX network SHALL perform messaging service subscription authentication for point to point messaging delivery.

R-[037] The WiMAX Network SHALL assign best effort quality of service for all messages delivery.

R-[038] The WiMAX Network SHALL be capable to send same message received from SM subscriber to multiple recipients.

R-[039] The WiMAX Network SHALL be able to deliver SM to non WiMAX network unencrypted.

### **7.2.2. Subscriber Device Requirements**

R-[040] The WiMAX User Device SHALL indicate its ability to send/receive SM/MM service to the serving WiMAX ASN and CSN.

R-[041] The WiMAX User Device SHALL be configured with the home message server address. The address of home SM/MM server SHALL be stored in the WiMAX USIM/SIM card or in the user device. If configuration information is present in both WiMAX USIM/SIM card and the user device, the information stored in the USIM/SIM card take precedence over the user device.

R-[042] In addition to the current WiMAX user identity (e.g., NAI), the WiMAX User Device MAY support multiple address schemes such as 3GPP MSISDN or 3GPP2 MDN or email address when interworking with 3GPP/3GPP2 user devices, but at least one address scheme SHALL be supported.

R-[043] The WiMAX User Device SHALL be able to enable/disable Multimedia Message (MM) functionality based on an operator's policy (including allow roaming nationally, internationally or not allow roaming) or a user subscription to messaging service.

R-[044] A WiMAX MM User Device SHALL support multiple type of messaging formats (e.g., fax, SMS, Multimedia, voicemail, e-mail).

R-[045] When receiving terminating message, the WiMAX User Device SHALL notify the network (e.g., messaging server and/or other network entity) when the message storage capacity is reached.

R-[046] The WiMAX User Device SHOULD notify the network the availability to storage message after user received notification memory capacity exceeds notification. Note: this is similar to 3GPP TS 23.040 ref [002] memory is available or 3GPP TS 24.011 ref [005] SM-RL-Memory-Available-Request.

### **7.3 Roaming Requirements**

R-[047] The WiMAX User MAY have access to their messaging service if the visited network support WiMAX messaging service and home operator policy permit.

## **7.4 Charging and Network Management Requirements**

R-[048] The WiMAX messaging server SHALL support online (pre-paid), or offline (post-paid), or both online and offline charging by interoperating with charging system based on operator's policy.

Note: Settlements of the interworking messages are out of scope of this specification, it is expected to be handled through the service level agreement. For service providers already offers SM in their network, existing SMS charging model may apply. For new service providers deploying SM, existing 3GPP/2 SMS charging model may apply.

### **7.4.1. Charging model (Informative)**

The service provider can support various charging models, including:

- Charged to sender;
- Charged to the recipient;
- Charged to both sender and recipient ;

The SMS can support various charging mechanisms. The following charging characteristics may be considered:

- Message length, storage in the network, etc.
- Delivery transaction (e.g., simple delivery, enhanced delivery with retry, delivery report)
- Number of message sent,
- Number of message received,
- Roaming conditions,
- Prepaid subscriptions.

The MMS can support various charging mechanisms. The following charging characteristics may be considered:

- Message types, length, storage in the network, etc.
- Delivering time, upload/download methods,
- Number of message sent,
- Number of message received,
- Roaming conditions,
- Prepaid subscriptions,
- Based on bearer transport.

## **7.5 Security Requirements**

R-[049] The delivery network MAY apply encryption for the message it delivers to its user.

R-[050] The SMS and MMS server SHALL support WiMAX lawful intercept based on regional requirement.

## **8. Guidance and Recommendation to other WiMAX WGs**

The following are SPWG guidance and recommendation to other WGs on the design of messaging service:

- The WiMAX NWG and TWG specifications SHALL support both IMS and non IMS messaging solution.

- WiMAX Message Service SHALL NOT modify IEEE 802.16e standard and WiMAX system profile Rel 1.0/1.5 to ensure backward compatibility.

Note: A 16m solution is under development in IEEE 802.16m to transmit and deliver of a short message with delivery confirmation in idle mode. TWG/NWG may investigate this solution.