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Circuit-Switched Video Conferencing Services

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1. INTRODUCTION

1.1. Scope

This specification defines the functional characteristics and requirements of the circuit-switched video conferencing services. The service features and system requirements are defined to provide video conferencing services in 3GPP2 wireless telecommunications networks.

1.2. References

1. **A.S0001-A** Inter-operability Specification (IOS) for cdma2000 Access Network Interfaces

2. **C.R1001-C ver1.0** Administration of Parameter Value Assignments for cdma2000 Spread Spectrum Standards

3. **C.S0001-C** Introduction to cdma2000 Standards for Spread Spectrum Systems

4. **C.S0002-C** Physical Layer Standard for cdma2000 Spread Spectrum Systems

5. **C.S0003-C** Medium Access Control (MAC) Standard for cdma2000 Spread Spectrum Systems

6. **C.S0004-C** Signaling Link Access Control (LAC) Standard for cdma2000 Spread Spectrum Systems

7. **C.S0005-C** Upper Layer (Layer 3) Signaling Standard for cdma2000 Spread Spectrum Systems

8. **C.S0006-C** Analog Signaling Standard for cdma2000 Spread Spectrum Systems

9. **C.S0014-0** Enhanced Variable Rate Codec (EVRC), Speech Service Option 3 for Wideband Spread Spectrum Digital Systems

10. **C.S-0017-0-2** Data Service Options for Spread Spectrum Systems

11. **C.S0020-0** High Rate Speech Service Option 17 for Wideband Spread Spectrum Communication Systems

12. **C.S0030-0** Selectable Mode Vocoder (SMV) Service Option for Wideband Spread Spectrum Communication Systems

13. ISO/IEC 14496-2
Information Technology - Generic Coding of Audio-Visual Object, March 2002

14. ITU-T Recommendation G.723.1
Dual rate speech coder for multimedia communication transmitting at 5.3 & 6.3 kbit/s

15. ITU-T Recommendation G.729
Coding of Speech at 8kbit/s using Conjugate- Structure Algebraic- Code- Excited Linear- Prediction (CS- ACELP)

16. ITU-T Recommendation H.223
Multiplexing protocol for low bitrate multimedia communication

17. ITU-T Recommendation H.223 — Annex A
Multiplexing protocol for low bitrate multimedia communication over low error-prone channels

18. ITU-T Recommendation H.223 — Annex B
Multiplexing protocol for low bitrate multimedia communication over moderate error-prone channels

19. ITU-T Recommendation H.245
Control protocol for multimedia communication

20. ITU-T Recommendation H.263
Video coding for low bitrate communication, November 2001

21. ITU-T Recommendation H.324
Terminal for low bitrate multimedia communication

22. TS 26.071 Adaptive Multi-Rate (AMR) Speech Codec; General Description

23. TS 26.110 Codec for Circuit switched Multimedia Telephony Service; General Description (Version 5.0.0), June 2002

24. TS 26.111 Codec for Circuit switched Multimedia Telephony Service; Modifications to H.324 (version 5.0.0), June 2002

1.3. Abbreviations

For the purpose of this document, the following abbreviations apply:

3G	Third Generation system
3GPP2	Third Generation Partnership Project 2
3GPP-324M	Mobile Station for 3GPP Circuit-Switched Video Conferencing

Terminal	compliant with [23, 24]
BLOB	BLock Of Bits.
BS	Base Station. A fixed station used for communicating with mobile stations. Depending upon the context, the term base station may refer to a cell, a sector within a cell, or other part of the wireless system.
BSAP	Base Station Application Part. The application layer signaling protocol that provides messaging to accomplish the functions of the IOS A1 Interface component of the MSC-BS Interface.
IOS	Inter-Operability Specification for interfaces between an MSC and a BS (see [1]).
IOS A1	The IOS interface that carries signaling information between the Call Control (CC) and Mobility Management (MM) functions of the MSC and the call control component of the BS (BSC).
IOS A2	The IOS interface that carries 64/56 kbps PCM information (voice/data) between the Switch component of the MSC and the Selection/Distribution Unit (SDU) function of the BS (BSC).
ISUP	ISDN User Part
IWF	Interworking Function. In this document, this refers specifically to the interworking between different speech codecs (e.g., EVRC and 3GPP-AMR).
Mobile Station	A station in the Public Cellular Radio Telecommunications Service intended to be used while in motion or during halts at unspecified points. Mobile stations include portable units (e.g., hand-held personal units) and units installed in vehicles.
MS	Mobile Station
MSC	Mobile Switching Center
QoS	Quality of Service. The set of parameters and procedures associated with a service indicating the capabilities and constraints related to the delivery of the service.
QoS BLOB	The set of QoS parameters exchanged via cdma2000 signaling that defines the QoS context for a particular service instance.
RC	Radio Configuration. A set of Forward Traffic Channel and Reverse Traffic Channel transmission formats that are characterized by physical layer parameters such as transmission rates, modulation characteristics, and spreading rate.
RLP	Radio Link Protocol
RLP_BLOB	The set of RLP parameters that defines the RLP configuration (e.g., retransmission scheme, round trip time)

2. OVERVIEW OF VIDEO CONFERENCING SERVICES

2.1. General Descriptions

The document defines point-to-point video conferencing services.

Service options 57 and 58 provide video conferencing services capable of transferring multiplex audio, video and control data at speeds of 32 and 64 kbps respectively, over the air-interface (Um) between mobile stations and other terminals.

Service options 57 and 58 use the Radio Link Protocol defined in [10] to provide an octet stream transport service over forward and reverse traffic channels.

The MSC provides the protocol conversion between cdma2000 upper layer signaling and ISUP signaling.

Above the Radio Link Protocol, the ITU-T H.324 [21] group of protocols is used for the video conferencing service. ITU-T H.245 is used for conducting capability exchange and negotiations between the terminals, and for opening and closing of logical channels and other components of the video conferencing services. ITU-T H.223 [16, 17, 18] is used for multiplexing/demultiplexing video, audio and control data. The NSRP and CCSRL protocols defined in Annex C of ITU-T H.324 are used to transport the H.245 control messages reliably over the H.223 multiplex layer.

Interoperability with other networks, such as the 3GPP network, is provided.

2.2. Structure of the Video Conferencing Service System in the MS

The mobile station uses the encoders and decoders, and multiplexer specified in section 4. Input/output (I/O) interfaces for video, audio, and system control provided in the mobile station are out of scope of this specification.

The sending function in the mobile station encodes the data from each media source with the corresponding visual and audio encoder. The output of the encoders and the system control interface are multiplexed and sent to transport layer of the underlying wireless network.

The receiving function in the mobile station de-multiplexes the received data stream, and decodes the data with the corresponding video and audio decoders. The output is then sent to be played at local visual and audio players (see Figure 1).

After the Um interface has been established, control messages defined in [19] are used for video conferencing call setup procedures and for controlling other components specified in section 4.

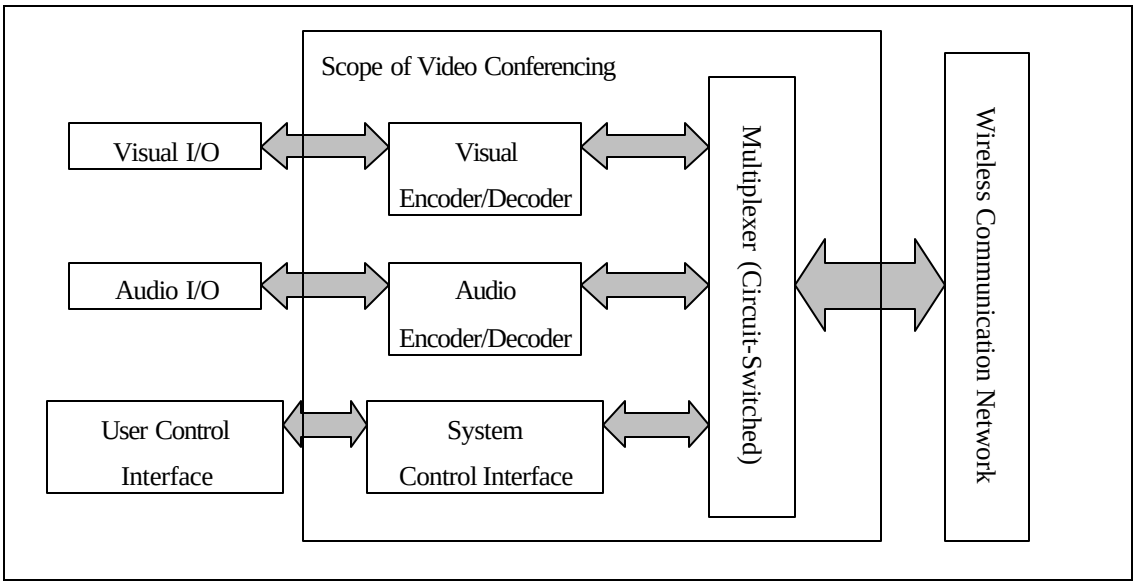

Figure 2-1 Scope and Structure of Circuit-Switched Video Conferencing Services

2.3. Video Conferencing Service Protocol Stack Reference Model

The video conferencing service architecture is defined by the protocols used across the different interface points. Figure 2-2 depicts the video conferencing service protocol stack for establishing the required bearer on the cdma2000 wireless link.

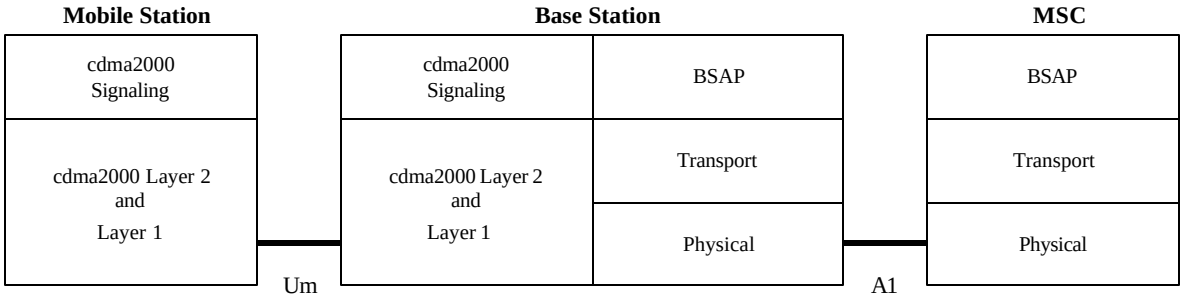

Figure 2-2 cdma2000 Bearer Call Setup Protocol Stack

Figure 2-3 depicts the protocol stack for the video conferencing bearer after establishing the cdma2000 wireless link.

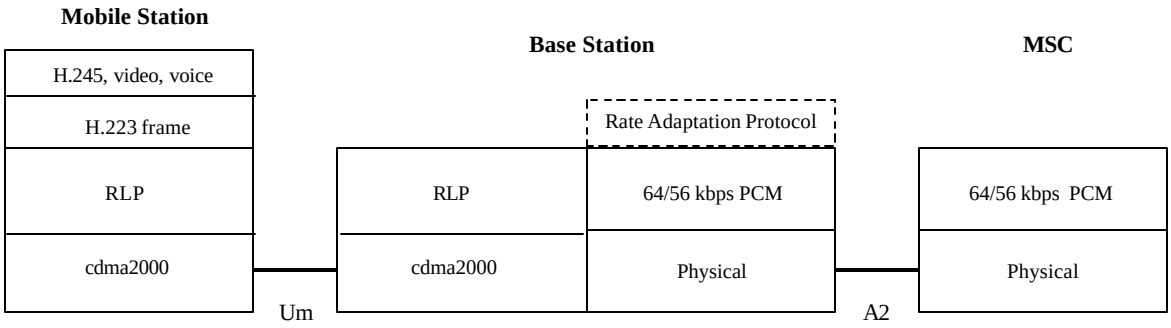

Figure 2-3 Video Conferencing Call Setup and Bearer Protocol Stack

The cdma2000 Layer 1, Layer 2, and signaling protocols between the MS and the BS in Figure 2-2 and Figure 2-3 are described in [3], [4], [5], [6], [7], and [8]. The 3G IOS A1 interface is used for signaling information for cdma2000 call setup as specified in [1]. The 3G IOS A2 interface is used for H.324 video conferencing call setup and the video conferencing bearer as specified in [18].

For the 32 kbps video service, the BS performs rate adaptation between the data stream carried over the RLP transport layer and the 64/56 kbps PCM link on the A2 interface.

3. UM INTERFACE REQUIREMENTS FOR ESTABLISHHING THE VIDEO CONFERENCING BEARER

The MS and the BS shall support the physical layer, multiplex sublayer, radio link management, and call control protocols as defined in [3], [4], [5], [6], [7], and [8]. The H.223 frames carrying multiplexed H.245 call control messages, video data, and voice data shall be sent over RLP at a maximum rate of 32 kbps for service option 57, and at a maximum rate of 64 kbps for service option 58.

The BS shall construct RLP frames carrying a user data rate of 32 or 64 kbps from a single channel of 64/56 kbps PCM received from the MSC.

3.1. RLP Requirements

At the U_m interface, the MS and the BS shall use Radio Link Protocol Type 3 as defined in [10]. In this specification, Radio Link Protocol Type 3 will be called simply RLP. To control the reliability and delay provided by RLP, the BS uses the RLP_BLOB defined in [10] to send the RLP retransmission scheme to the MS.

3.2. Initialization and Connection of Video Conferencing Service Options

The MS shall support service options 57 and 58. The BS should support service options 57 and 58.

The MS shall initiate the connection of the video conferencing service by requesting service option 57 or 58 in either a *Page Response Message*, *Origination Message*, or an *Enhanced Origination Message* as defined in [7].

If the BS receives a *Paging Request Message* for a video conferencing call from the MSC, the BS shall page the specific MS with the identified video conferencing service option.

3.2.1. Mobile Station Procedures

The MS shall connect the video conferencing service using the procedures defined in [7]. If service negotiation is required the MS shall perform the service negotiation procedures defined in [7].

The MS shall not propose or accept a service configuration whose attributes are inconsistent with the valid service configuration attribute table for service options 57 and 58 as shown in Table 1 . The default service configuration for video conferencing service options 57 and 58 shall be as shown in Table 1 .

Table 1 Valid Service Configuration Attributes for Service Options 57 and 58

Service Configuration Attribute	Valid Selections
Forward FCH/DCCH Multiplex Option	0x1
Reverse FCH/DCCH Multiplex Option	0x1
Forward FCH/DCCH Transmission Rates	For the FCH, Rates 1, 1/2, 1/4, and 1/8 enabled. For the DCCH, Rate 1 enabled, Rates 1/2, 1/4, and 1/8 not enabled.
Reverse FCH/DCCH Transmission Rates	For the FCH, Rates 1, 1/2, 1/4, and 1/8 enabled. For the DCCH, Rate 1 enabled, Rates 1/2, 1/4, and 1/8 not enabled.
Forward Traffic Type	**Primary** or Secondary
Reverse Traffic Type	**Primary** or Secondary
Forward FCH/DCCH Radio Configuration	RC **3**, 4, 6, 7
Reverse FCH/DCCH Radio Configuration	RC **3**, 5
Forward Supplemental Channel Multiplex Option	0xf20
Reverse Supplemental Channel Multiplex Option	0xf20
Forward Supplemental Channel Frame Length	20 ms
Reverse Supplemental Channel Frame Length	20 ms
Forward Supplemental Radio Configuration	RC **3**, 4, 6, 7
Reverse Supplemental Radio Configuration	RC **3**, 5
where multiple options are supported the default is in bold	

3.2.2. Base Station Procedures

The BS shall connect the video conferencing service using the procedures defined in [7]. If service negotiation is required the BS shall perform the service negotiation procedures defined in [7].

The BS shall not propose or accept a service configuration whose attributes are inconsistent with the valid service configuration attribute table for service options 57 and 58 as shown in Table 1 . The default service configuration for video conferencing service options 57 and 58 shall be as shown in Table 1 .

The BS shall assign Forward and Reverse Supplemental channels to constantly deliver a user data rate of at least 32 or 64kbps over the Supplemental channel. Variable supplemental channel rate operation below 32 and 64 kbps shall not be allowed for service options 57 and 58, respectively.

3.2.3. Traffic Channel Handoff

Following a CDMA-to-CDMA hard handoff (see [7]) involving transitions between disjoint sets of BS/MSCs or a frequency change, RLP shall be immediately initialized according to the initialization procedures described in [10].

3.3. Quality of Service (QoS)

3.3.1. QoS Parameters

The set of QoS parameters that apply to service options 57 and 58 are defined in Table 2.

For each QoS parameter in Table 2, the set of allowable values that can be selected by service options 57 and 58 are defined. If a parameter value is not specified in Table 2, it shall be considered reserved and it shall not be used.

For service options 57 and 58, QoS parameters shall be identical for the forward and reverse links.

Table 2 QoS Parameters Applicable to Service Options 57 and 58

QoS Parameter	SO	Allowable Value(s)

Assured Mode	57, 58	Assured mode service. This is the default value.
Forward Link Priority Reverse Link Priority	57, 58	The user's priority should not be reduced.
Forward Link Minimum User Data Rate	57	32 kbps. This is the default value.
Reverse Link Minimum User Data Rate	58	64 kbps. This is the default value
Forward Link Data Loss Rate Reverse Link Data Loss Rate[1]	57, 58	There are no specific values defined for this parameter. Both the MS and BS should provide appropriate FER for this service.
Forward Link Maximum Delay Reverse Link Maximum Delay[2]	57, 58	There are no specific values defined for this parameter. Both the mobile station and base station should provide the minimum amount of delay for this service.

In Table 2 the data loss rate is the error rate provided above the RLP layer. The maximum delay is defined as the amount of time user data can be held in the transmit queue (i.e., from the moment it is submitted to RLP for transmission until its actual transmission on a physical channel).

3.3.2. Mobile Station Procedures for QoS

The MS shall use the default set of QoS parameters as defined in Table 2 for service options 57 and 58.

As there is only one set of default parameters, there is no MS QoS BLOB defined for service options 57 and 58.

3.3.3. Base Station Procedures for QoS

The BS shall use the default set of QoS parameters as defined in Table 2 for service options 57 and 58.

---

[1] The data loss rate is the error rate provided above the RLP layer.

[2] Maximum delay is defined as the amount of time user data can be held in the transmit queue (i.e., from the moment it is submitted to RLP for transmission until its actual transmission on a physical channel).

As there is only one set of default parameters, there is no BS QoS BLOB defined for service options 57 and 58.

4. VIDEO CONFERENCING SERVICES MULTIMEDIA SYSTEMS

ITU-T H.324 recommendation with Annex C shall be used for the 3GPP2 circuit-switched video conferencing service. For the rest of this section H.324 refers to ITU-T H.324 with Annex C.

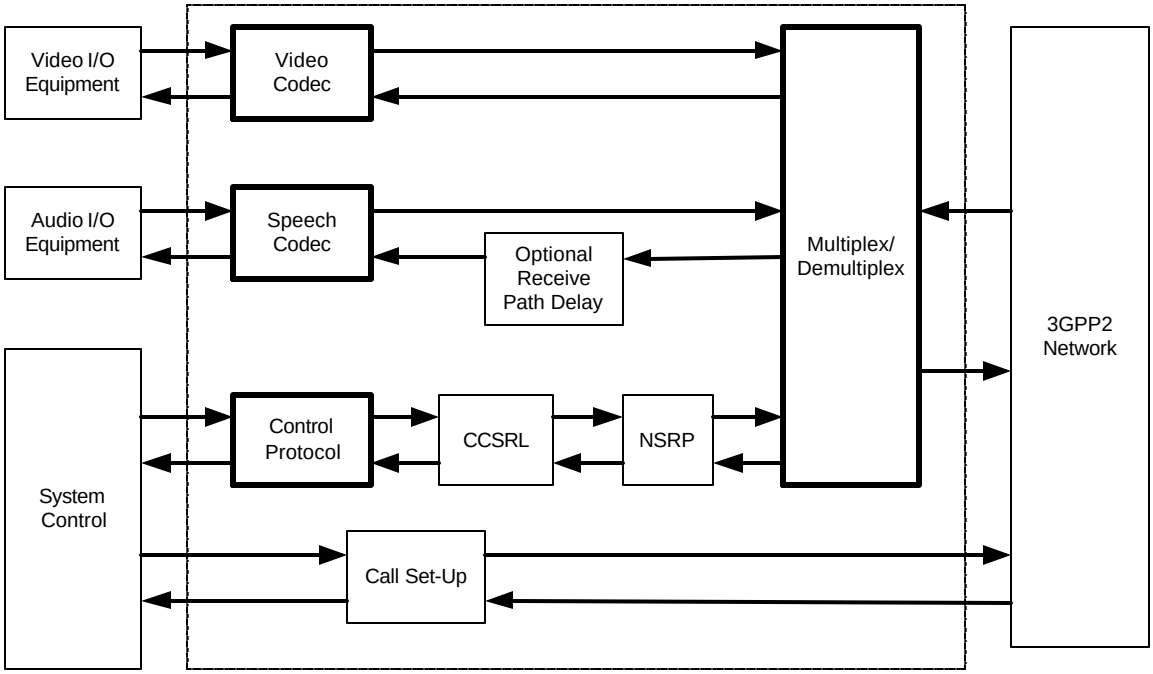

Figure 4-1 H.324 for Video Conferencing Specifications

4.1. Multiplex Protocol

The MS shall support ITU-T H.223 with both Annexes A [17] and B [18] in order to multiplex and demultiplex video, audio, and control messages. The MS may support other annexes in H.223.

4.2. Control Protocol

The MS shall support version 7 of ITU-T H.245 as the control protocol for capabilities exchange, master/slave determination, opening and closing of logical channels, and transmission of other control messages. The MS may support newer versions of ITU-T H.245.

4.3. Video Codec

4.3.1. Mandatory Video Codecs

The MS shall support MPEG-4 Simple Profile Level 0 [13] and H.263 baseline [20] video codecs.[3]

4.3.2. Optional Video Codecs

4.3.2.1. MPEG-4 Simple Scalable Profile

The MS should support the MPEG-4 Visual codec with Simple Scalable Profile, Level 0 [13].

4.3.2.2. H.263 Profile 3

The MS should support profile 3 for the H.263 video codec [20], which includes the following annexes:

- Annex I – Advanced Intraframe Coding;
- Annex J – Deblocking Filter;
- Annex K – Slice Structure Mode, without RS and ASO submodes;
- Annex T – Modified Quantizer.

4.3.2.3. H.263 Profile 4

The MS should support profile 4 for the H.263 video codec [20], which includes the following annexes in addition to the annexes in profile 3:

- Annex V – Data Partitioned Slice Mode;
- Annex W (subclause W 6.3.8) - Previous Picture Header Repetition.

4.4. Speech Codec

No mandatory speech codec is required for the mobile station.

The mobile station should support 13k (PureVoice) QCELP [11], AMR [22], EVRC [9], and SMV [12] speech codecs. Other speech codecs may also be supported.

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[3] The MS can decode and generate bit streams that are compliant with MPEG-4 Simple Profile Level 0 and H.263 baseline.

5. EXAMPLES OF CALL SETUP PROCEDURES

The video conferencing call setup procedure is divided into two phases: the cdma2000 call setup and the H.324 call setup.

cdma2000 call setup is first performed using the procedures defined in [3], [4], [5], [6], [7], and [8] to establish the bearer for the H.324 protocols. The service option field within the *Origination Message* is set to service option 57 or 58 defined in [2].

When the MSC receives the *CM Service Request Message* with a video conferencing service option, the MSC sends an ISUP message corresponding to the service option to the MSC of the mobile station being called. The BS sends a *Paging Message* with that service option to the mobile station.

After the cdma2000 call setup procedures have established the H.324 bearer, the negotiation, control, and multiplexing procedures defined in ITU-T Recommendation H.245/H.223 are performed.

If codec conversion is not needed, both terminals exchange H.245/H.223 messages directly with each other. If codec conversion (such as between EVRC and 3GPP-AMR) is needed, each terminal exchanges H.245/H.223 messages with the gateway function performing the conversion.

5.1. Mobile-to-mobile video conference call

Figure 5-1 illustrates an example call where both terminals are 3GPP2 mobile stations that select a 32 kbps video call.

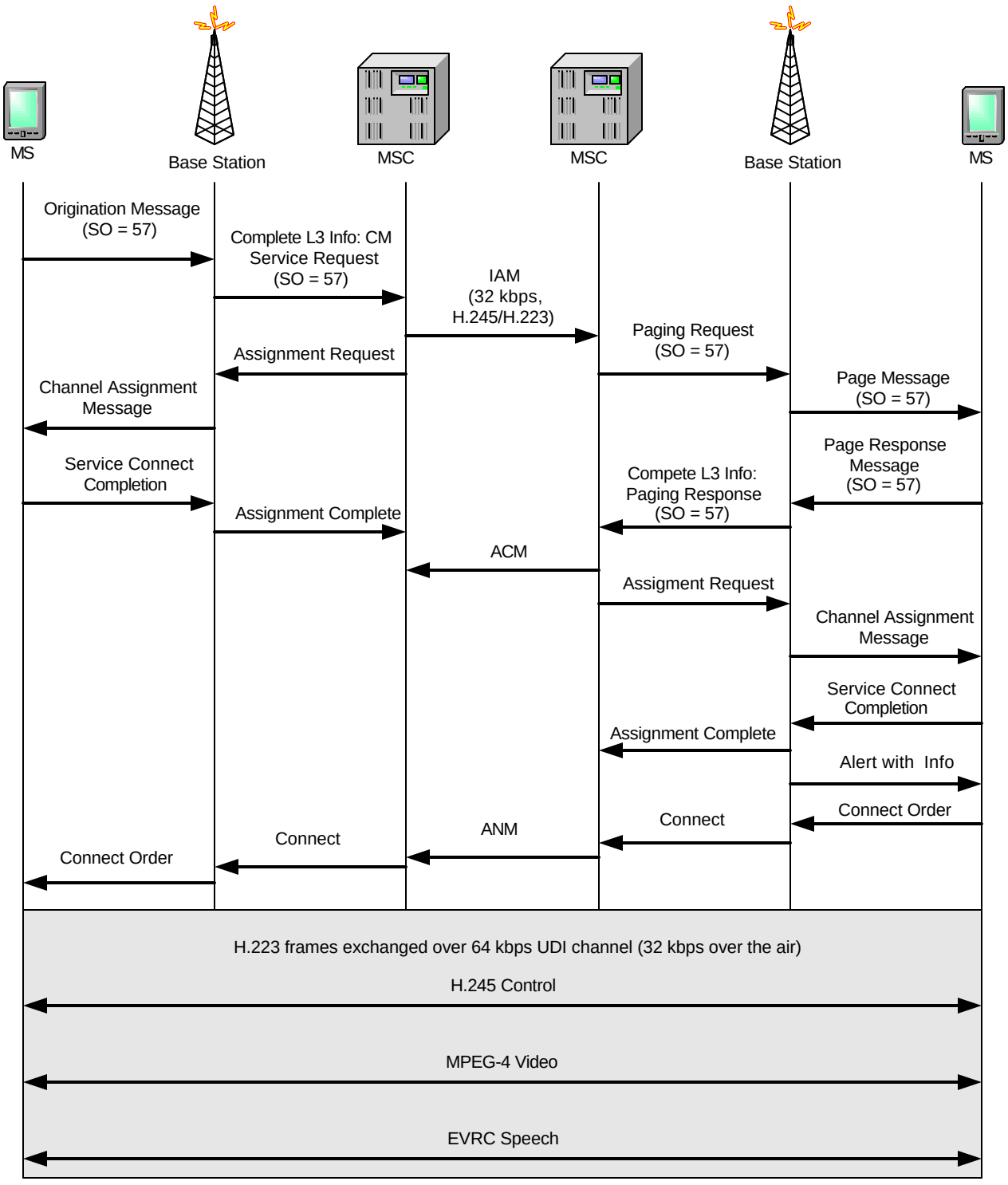

Figure 5-1 Mobile-to-mobile video conference call

5.1.1. cdma2000 Call Setup Procedure

The mobile station sends an *Origination Message* requesting service option 57. The MSC generates an ISUP parameter requesting 32k bandwidth and H.245/H.223, and sends it to the MSC of the mobile station being called. The called mobile station responds to the *Paging Message* with service option 57.

5.1.2. H.324 Call Setup Procedure

After the cdma2000 call setup procedure, the negotiation, control and multiplex messages defined in [19] are exchanged between the two mobile stations.

5.2. Call between the mobile station and a 3GPP-324M

Figure 5-2 illustrates an example call made from a 3GPP2 mobile station to a 3GPP-324M terminal.

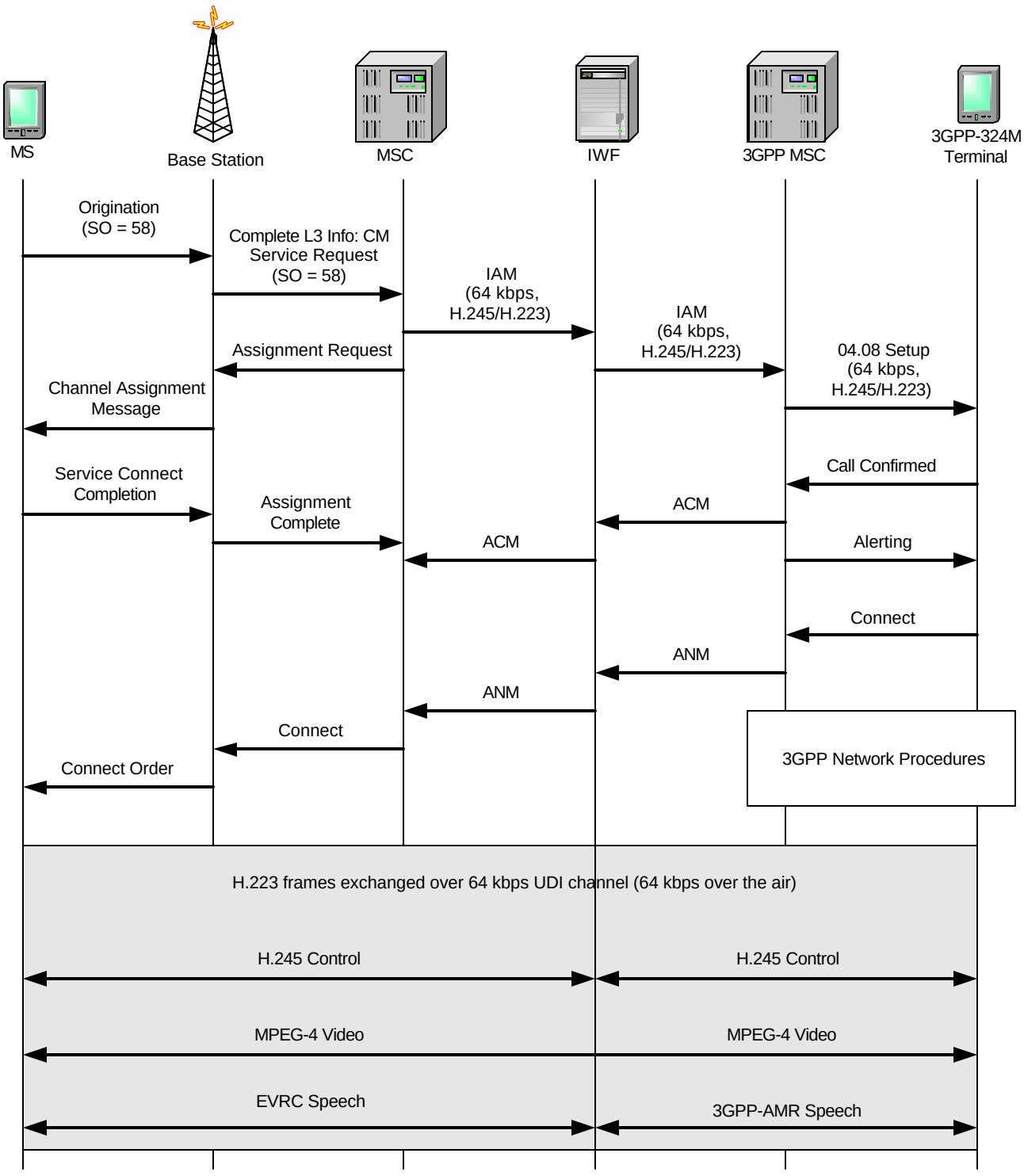

Figure 5-2 Call between the mobile station and a 3GPP-324M terminal

5.2.1. cdma2000 and 3GPP Call Setup Procedure

The mobile station sends an *Origination Message* requesting service option 58. The MSC generates an ISUP parameter requesting 64 kbps bandwidth and H.245/H.223, and sends it to the MSC of the 3GPP-324M terminal being called. The MSC of the called terminal sends a *Setup message* for the 64kbps service to the 3GPP-324M terminal, which responds.

5.2.2. H.324 Call Setup Procedure

After the cdma2000 and 3GPP call setup procedures, both terminals exchange the negotiation and control messages defined in [19] with the IWF. In this example, the IWF negotiates different video and speech codecs for the two terminals. The IWF performs the necessary conversion between the EVRC and 3GPP-AMR speech formats.