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**3RD GENERATION
PARTNERSHIP
PROJECT 2
"3GPP2"**

VoIP Codecs and Protocols

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No Text

1
2 **Foreword**

3
4 This technical specification recommends codecs as well as protocol configuration for efficient support
5 of VoIP over HRPD Rev A.
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1 Introduction

This specification includes recommendations for VoIP codecs as well as protocol configuration to enable efficient support of VoIP over HRPD Rev A. VoIP codecs are chosen from existing 3GPP2 technologies keeping in mind system efficiency as well as quality considerations. Recommendations are provided for transport protocols as well as for 3GPP2-specific system parameter settings for RoHC, RLP and RLMAC.

2 References

The following standards are referenced in this text. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based upon this document are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. ANSI and TIA maintain registers of currently valid national standards published by them.

- [1] 3GPP2 C.S0014-B, “Enhanced Variable Rate Codec, Speech Service Options 3 and 68 for Wideband Spread Spectrum Digital Systems”, May 2006.
- [2] 3GPP2 C.S0014-A, “Enhanced Variable Rate Codec, Speech Service Option 3 for Wideband Spread Spectrum Digital Systems”, May 2004.
- [3] 3GPP2 C.S0014-C, “Enhanced Variable Rate Codec, Speech Service Options 3, 68 and 70 for Wideband Spread Spectrum Digital Systems”, February 2007.
- [4] IETF RFC 3095, Borman, et al, “RObust Header Compression (ROHC): Framework and four profiles: RTP, UDP, ESP, and uncompressed”, July 2001.
- [5] 3GPP2 C.S0055-0 v1.0, “Packet Switched Video Telephony Services (PSVT/MCS)”, March 2007.
- [6] 3GPP2 C.S0024-A, “cdma2000 High Rate Packet Data Air Interface Specification”, August 2005.
- [7] IETF RFC 3264, Rosenberg and Schulzrinne, “An Offer/Answer Model with the Session Description Protocol (SDP)”, June 2002.
- [8] 3GPP2 X.S0013-004-A v1.0, “All-IP Core Network Multimedia Domain: IP Multimedia Call Control Protocol Based on SIP and SDP – Stage 3”, November 2005.
- [9] 3GPP2 C.S0076-0 v1.0, “Discontinuous Transmission (DTX) of Speech in cdma2000 Systems”, December 2005.

3 Definitions, Symbols and Abbreviations

This section contains definitions, symbols and abbreviations that are used throughout the document.

3.1 Symbols and Abbreviations

3GPP2	3 rd Generation Partnership Project 2
E-MFPA	Enhanced Multi Flow Packet Application
EVRC	Enhanced Variable Rate Codec
EVRC-B	Enhanced Variable Rate Codec-B
EVRC-WB	Enhanced Variable Rate Codec- Wideband
HRPD	High Rate Packet Data
IP	Internet Protocol
IP-ID	Internet Protocol Identifier
MAC	Medium Access Control
QoS	Quality of Service
RFC	Request for Comments
RLMAC	Reverse Link Medium Access Control
RLP	Radio Link Protocol
RoHC	Robust Header Compression
RS-1	Rate Set-1
RTP	Real Time Protocol
SIP	Session Initiation Protocol
UDP	User Datagram Protocol
VoIP	Voice over Internet Protocol

4 SDP Offer/Answer

The SDP offer typically contains at least one audio media line (m=) offering one or more RTP payload formats. For each media line, the codecs are listed in order of decreasing preference with the most preferred codec listed first.

The SDP answer for each audio media line (m=) typically contains only one codec format, i.e., the first codec format in the offer that can be used by the answering VoIP Terminal for the VoIP session.

The selection of the voice codec and any parameters (for example [9]) associated with the codec used in a VoIP call shall follow [7] for non-IMS call control scenarios and [8] for IMS call control scenarios.

5 Media

5.1 Voice

5.1.1 Narrowband

Narrowband-only VoIP terminals shall support EVRC-B [1] and EVRC [2] codecs. EVRC-B is the default and most preferred voice codec for these VoIP terminals. The audio m-lines of the SDP offer shall contain EVRC-B as one of the offered codecs.

5.1.2 Wideband

Wideband-capable VoIP terminals shall support EVRC-WB [3] in addition to EVRC-B and EVRC codecs. EVRC-WB is the default and most preferred codec for wideband-capable VoIP terminals. The audio m-lines of the SDP offer shall contain EVRC-WB as one of the offered codecs.

5.2 VoIP Transport

5.2.1 RTP Header and Packetization

Maintaining low end-to-end delays is important for VoIP. Thus, a VoIP terminal shall send VoIP frames without any bundling, i.e., each speech frame in a separate RTP packet.

5.2.2 Header Compression

To reduce RTP/UDP/IP overhead, a VoIP terminal shall use Robust Header Compression (RoHC) [4] to compress IP/UDP/RTP headers for VoIP flows. The recommended configuration for RoHC is described below:

- The recommended profile to use is the RTP profile.
- The recommended mode of operation is the Optimistic 'O' mode (Even this in case, RoHC starts in the Unidirectional 'U' mode, as defined in RFC 3095, and then transitions to the 'O' mode).
- Timer-based compression is recommended to compress the RTP timestamp.
- To ensure robust operation, it is recommended to set the window size (as used in Window-Based LSB encoding) to 6.
- To ensure robust operation, it is recommended to set the number of updates sent by the RoHC compressor as per the Optimistic Approach principle to 6.
- To ensure that RoHC can tolerate jitter on the air link when doing timer-based compression, it is recommended to set the value of Max_Jitter_CD (Max_Jitter_CD is the upper bound of jitter expected on the communication channel between compressor and decompressor) to 150 msec.
- To handle out-of-order packets, it is recommended to set the 'p' value for RTP SN (Sequence Number) to 6. Note that RFC 3095 recommends setting this parameter to 1, but it assumes a reordering-free channel. Since reordering is likely to happen over an HRPD Rev A channel, it is recommended to set this parameter to a value that is large enough to handle this reordering.

- In order to enable timer-based compression, the VoIP Terminal should set the parameter `TimerBasedCompressionSupported` in the `ATSupportedFlowProtocolParametersPP` attribute to 1 when the Flow Protocol or Route Protocol is RoHC. Also, when the Flow Protocol or Route Protocol is RoHC, the parameter `TimerBasedCompression` in the `FlowNNFlowProtocolParametersRev` attribute should be set to 1.
- To handle the IP-ID (IP Identification) efficiently for IPv4, it is recommended to set the IP-ID to the same value as the RTP SN. This ensures that the IP-ID is completely compressed away by the RoHC compressor.

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6 HRPD Rev A System Configuration for VoIP Flow

6.1 RLP (Radio Link Protocol) Configuration

The recommendation RLP configuration for a VoIP flow is as follows (note that not all the RLP parameters are shown here; only those that are critical for efficient support of VoIP are shown):

- FlowRRNakEnableFwd: 0x00 (Nak-based retransmission disallowed)
- FlowRRNakEnableRev: 0x00 (Nak-based retransmission disallowed)
- FlowRRPhysicalLayerNakEnableRev: 0x00 (RLP is to ignore physical layer Reverse Traffic Packets missed indication)
- ReservationMMIdleStateFwd: 0x01 (Closes when connection is closed)
- ReservationMMIdleStateRev: 0x01 (Closes when connection is closed)
- FlowRRSequenceLengthFwd: 0x00 (6-bit sequence number)
- FlowRRSequenceLengthRev: 0x00 (6-bit sequence number)
- FlowRRFlowProtocolPDUFwd: 0x01 (Packet stream)
- FlowRRFlowProtocolPDUREV: 0x01 (Packet stream)
- FlowRRDataUnitFwd: 0x01 (Segment sequencing)
- FlowRRDataUnitRev: 0x01 (Segment sequencing)
- FlowRRRouteProtocolPDUFwd: 0x01 (Packet stream)
- FlowRRRouteProtocolPDUREV: 0x01 (Packet stream)
- FlowRRSimultaneousDeliveryOnBothRoutesFwd: 0x01 (Simultaneous delivery on both routes allowed)
- FlowRROutOfOrderDeliveryToRouteProtocolFwd: 0x01 (Out-of-order delivery allowed)
- FlowRRTimersFwd:
 - AbortTimer: 0x00c8 (200 msec). This assumes that RoHC supports out-of-order delivery.
- FlowRRTimersRev:
 - AbortTimer: 0x00c8 (200 msec). This assumes that RoHC supports out-of-order delivery.
- FlowRRTransmitAbortTimerRev: 0x0028 (200 msec).

6.2 RLMAC (Reverse Link Medium Access Control) Configuration

The recommended RLMAC configuration for a VoIP flow is shown below. Note that not all RLMAC parameters are mentioned here; all other RLMAC parameters should be set as per the default values

in [6]. Also, it is recommended to use direct Rise over Thermal based measurement control on the Reverse Link.

- 1
- 2
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- 4 • CommonPowerParameters
- 5 ○ AllocationStagger: 0000
- 6
- 7 ○ TxT2Pmin: 0x1A
- 8
- 9 ○ RPCStep: 01
- 10
- 11
- 12 • PowerParameters128
- 13
- 14 ○ LoLatT2PTransition128: 0x2
- 15
- 16 ○ LoLatTerminationTarget128: 0x2
- 17
- 18 ○ HiCapT2PTransition128: 0x3
- 19
- 20 ○ HiCapTerminationTarget128: 0x3
- 21
- 22 ○ T2PLoLatPreTransition128: 0x0D
- 23
- 24 ○ T2PLoLatPostTransition128: 0x03
- 25
- 26 ○ T2PHiCapPreTransition128: 0x03
- 27
- 28 ○ T2PHiCapPostTransition128: 0x03
- 29
- 30
- 31 • PowerParameters256
- 32 ○ LoLatT2PTransition256: 0x2
- 33
- 34 ○ LoLatTerminationTarget256: 0x2
- 35
- 36 ○ HiCapT2PTransition256: 0x3
- 37
- 38 ○ HiCapTerminationTarget256: 0x3
- 39
- 40 ○ T2PLoLatPreTransition256: 0x1A
- 41
- 42 ○ T2PLoLatPostTransition256: 0x0F
- 43
- 44 ○ T2PHiCapPreTransition256: 0x0F
- 45
- 46 ○ T2PHiCapPostTransition256: 0x0F
- 47
- 48
- 49 • PowerParameters512
- 50 ○ LoLatT2PTransition512: 0x2
- 51
- 52 ○ LoLatTerminationTarget512: 0x2
- 53
- 54 ○ HiCapT2PTransition512: 0x3
- 55
- 56 ○ HiCapTerminationTarget512: 0x3
- 57
- 58 ○ T2PLoLatPreTransition512: 0x26

1	○ T2PLoLatPostTransition512:	0x1C
2	○ T2PHiCapPreTransition512:	0x1C
3		
4	○ T2PHiCapPostTransition512:	0x1C
5		
6		
7		
8	● PowerParameters768	
9	○ LoLatT2PTransition768:	0x2
10		
11	○ LoLatTerminationTarget768:	0x2
12		
13	○ HiCapT2PTransition768:	0x3
14		
15	○ HiCapTerminationTarget768:	0x3
16		
17	○ T2PLoLatPreTransition768:	0x2E
18		
19	○ T2PLoLatPostTransition768:	0x23
20		
21	○ T2PHiCapPreTransition768:	0x23
22		
23	○ T2PHiCapPostTransition768:	0x23
24		
25		
26	● PowerParameters1024	
27	○ LoLatT2PTransition1024:	0x2
28		
29	○ LoLatTerminationTarget1024:	0x2
30		
31	○ HiCapT2PTransition1024:	0x3
32		
33	○ HiCapTerminationTarget1024:	0x3
34		
35	○ T2PLoLatPreTransition1024:	0x32
36		
37	○ T2PLoLatPostTransition1024:	0x28
38		
39	○ T2PHiCapPreTransition1024:	0x28
40		
41	○ T2PHiCapPostTransition1024:	0x28
42		
43		
44	● BucketLevelMaxNN:	0x66
45		
46		
47		
48	● TransmissionModeNN:	0x01
49		
50		
51	● BucketFactorNN	
52		
53	○ NumT2PAxisValues:	0x0
54		
55	○ NumFRABAxisValues:	0x0
56		
57	○ T2PAxis00:	0x00
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1		
2	○	FRABAxis0: 0x8
3		
4	○	BucketFactorT2PAxis00FRABAxis0: 0x08
5		
6	•	T2PInflowRangeNN (NN > 0)
7		
8	○	T2PInflowmin: 0x0F
9		
10	○	T2PInflowmax: 0x78
11		
12		
13	•	T2PTransitionFunctionNN (NN > 0)
14		
15	○	NumT2PAxisValues: 0x2
16		
17	○	NumFRABAxisValues: 0x0
18		
19	○	T2PAxis00: 0x00
20		
21	○	T2PAxis01: 0x34
22		
23	○	T2PAxis02: 0x35
24		
25	○	FRABAxis0: 0x8
26		
27	○	T2PUpT2PAxis00FRABAxis0: 0x1C
28		
29	○	T2PUpT2PAxis01FRABAxis0: 0x1C
30		
31	○	T2PUpT2PAxis02FRABAxis0: 0x88
32		
33	○	T2PDnT2PAxis00FRABAxis0: 0xB0
34		
35	○	T2PDnT2PAxis01FRABAxis0: 0xB0
36		
37	○	T2PDnT2PAxis02FRABAxis0: 0xB0
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7 HRPD Rev A System Configuration for SIP Flow

7.1 RLP (Radio Link Protocol) Configuration

The recommendation RLP configuration for a SIP flow is as follows (note that not all the RLP parameters are shown here; only those that are critical for efficient support of SIP are shown):

- FlowSSNakEnableFwd: 0x01 (Nak-based retransmission enabled)
- FlowSSNakEnableRev: 0x01 (Nak-based retransmission enabled)
- ReservationMMIdleStateFwd: 0x00 (Reservation does not change states when a connection is closed)
- ReservationMMIdleStateRev: 0x00 (Reservation does not change states when a connection is closed)
- FlowSSSequenceLengthFwd: 0x02 (22-bit sequence number)
- FlowSSSequenceLengthRev: 0x02 (22-bit sequence number)
- FlowSSFlowProtocolPDUFwd: 0x01 (Packet stream)
- FlowSSFlowProtocolPDURev: 0x01 (Packet stream)
- FlowRRDataUnitFwd: 0x00 (Octet sequencing)
- FlowRRDataUnitRev: 0x00 (Octet sequencing)
- FlowSSRouteProtocolPDUFwd: 0x01 (Packet stream)
- FlowSSRouteProtocolPDURev: 0x01 (Packet stream)
- FlowSSSimultaneousDeliveryOnBothRoutesFwd: 0x01 (Simultaneous delivery on both routes allowed)
- FlowSSOutOfOrderDeliveryToRouteProtocolFwd: 0x01 (Out-of-order delivery allowed)
- FlowSSTimersFwd:
 - AbortTimer: 0x01f4 (500 msec).
 - FlushTimer: 0x0064 (100 msec)
- FlowSSTimersRev:
 - AbortTimer: 0x01f4 (500 msec).
 - FlushTimer: 0x0064 (100 msec)
- FlowSSTransmitAbortTimerRev: 0x00c8 (1000 msec).

7.2 RLMAC (Reverse Link Medium Access Control) Configuration

The recommended RLMAC configuration for a SIP flow is shown below. Note that not all RLMAC parameters are mentioned here; all other RLMAC parameters should be set as per the default values in [6].

All the recommended RLMAC parameter values mentioned in Section 5.1.2 for a VoIP flow also apply to a SIP flow, except for the parameters mentioned below:

- T2PTransitionFunctionNN (NN > 0)
 - T2PUpT2PAxis00FRABAxis0: 0x1B
 - T2PUpT2PAxis01FRABAxis0: 0x1B
 - T2PUpT2PAxis02FRABAxis0: 0xB0

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8 QoS Configuration/Activation

Section 7.1 of [5] defines procedures for pre-configuring QoS reservations and Activating QoS at call origination. A VoIP terminal shall follow the QoS procedures defined in Section 7.1 of [5] to configure and activate QoS for VoIP.

Section 7.2 of [5] defines procedures for negotiating end-to-end QoS between VoIP terminals. A VoIP terminal should follow the end-to-end QoS negotiation procedures defined in Section 7.2 of [5].