SingleRAN

IP Transmission Efficiency Improvement Feature Parameter Description

Issue Draft A

Date 2018-12-30

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Contents

1 Change History

This section describes changes not included in the "Parameters", "Counters", "Glossary", and "Reference Documents" chapters. These changes include:

- Technical changes

  Changes in functions and their corresponding parameters
- Editorial changes

  Improvements or revisions to the documentation

1.1 SRAN15.1 Draft A (2018-12-30)

This issue introduces the following changes to SRAN13.1 01 (2018-04-10).

Technical Changes

Change Description	Parameter Change
Changed the name of the ***IPMUXSWITCH*** parameter from **IPMUX Switch** to **IP MUX Switch**. Changed the name of the ***IPMUXDEMULTIPLEXSW*** parameter from **IPMUX Demultiplexing Switch** to **IP MUX Demultiplexing Switch**.	Modified parameters: ● ***IPMUXSWITCH*** ● ***IPMUXDEMULTIPLEXSW***
Added the switch to control the IP MUX demultiplexing function for Abis MUX on a GBTS. For details, see the following section: **4.4 Abis MUX and Ater MUX (Supported Only by GSM)**	Added the ***IPMUXDEMULTIPLEX*** parameter.

Change Description	Parameter Change
Added the new transmission configuration model. For details, see the following sections: ● **4.2.4.2 Data Configuration** ● **4.4.4.2 Data Configuration** ● **4.5.4.1 Data Configuration**	None

Editorial Changes

Reorganized this document using a new template.

2 About This Document

2.1 General Statements

Purpose

Feature Parameter Description documents are intended to acquaint readers with:

- The technical principles of features and their related parameters
- The scenarios where these features are used, the benefits they provide, and the impact they have on networks and functions
- Requirements of the operating environment that must be met before feature activation
- Parameter configuration required for feature activation, verification of feature activation, and monitoring of feature performance

  NOTE

  This document only provides guidance for feature activation. Feature deployment and feature gains depend on the specifics of the network scenario where the feature is deployed. To achieve the desired gains, contact Huawei professional service engineers.

Software Interfaces

Any parameters, alarms, counters, or managed objects (MOs) described in Feature Parameter Description documents apply only to the corresponding software release. For future software releases, refer to the corresponding updated product documentation.

Trial Features

Trial features are features that are not yet ready for full commercial release for certain reasons. For example, the industry chain (terminals/CN) may not be sufficiently compatible. However, these features can still be used for testing purposes or commercial network trials. Anyone who desires to use the trial features shall contact Huawei and enter into a memorandum of understanding (MoU) with Huawei prior to an official application of such trial features. Trial features are not for sale in the current version but customers may try them for free.

Customers acknowledge and undertake that trial features may have a certain degree of risk due to absence of commercial testing. Before using them, customers shall fully understand not

only the expected benefits of such trial features but also the possible impact they may exert on the network. In addition, customers acknowledge and undertake that since trial features are free, Huawei is not liable for any trial feature malfunctions or any losses incurred by using the trial features. Huawei does not promise that problems with trial features will be resolved in the current version. Huawei reserves the rights to convert trial features into commercial features in later R/C versions. If trial features are converted into commercial features in a later version, customers shall pay a licensing fee to obtain the relevant licenses prior to using the said commercial features. If a customer fails to purchase such a license, the trial feature(s) will be invalidated automatically when the product is upgraded.

2.2 Applicable RAT

This document applies to GSM, UMTS, LTE FDD, LTE TDD, and NB-IoT. This feature works the same way with each of these RATs.

For definitions of base stations described in this document, see section "Base Station Products" in *SRAN Networking and Evolution Overview*.

2.3 Features in This Document

This document describes the following features.

Feature ID	Feature Name	Section
LBFD-003004	Compression & Multiplexing over E1/T1	See the description of each feature.
MLBFD-12000304	Compression & Multiplexing over E1/T1	
TDLBFD-003004	Compression & Multiplexing over E1/T1	
LBFD-00300401	IP Header Compression	**5 Header Compression**
TDLBFD-00300401	IP Header Compression	
LBFD-00300402	PPP MUX	**4.5 PPP MUX**
TDLBFD-00300402	PPP MUX	
LBFD-00300403	ML-PPP/MC-PPP	**6 MLPPP/MC-PPP**
TDLBFD-00300403	ML-PPP/MC-PPP	

Feature ID	Feature Name	Section
GBFD-118604	Abis MUX	**4.4 Abis MUX and Ater MUX (Supported Only by GSM)**
GBFD-118612	Abis IPHC	**5 Header Compression**
GBFD-118610	UDP MUX for A Transmission	**4.3 UDP MUX (Supported Only by GSM and UMTS)**
WRFD-050420	FP MUX for IP Transmission	**4.2 FP MUX (Supported Only by UMTS)**
WRFD-050412	UDP MUX for Iu-CS Transmission	**4.3 UDP MUX (Supported Only by GSM and UMTS)**
WRFD-050402	IP Transmission Introduction on Iub Interface	**4.2 FP MUX (Supported Only by UMTS)**

NOTE

The FP MUX function of the WRFD-050402 IP Transmission Introduction on Iub Interface feature is described in this document and other major part of this feature is described in *IPv4 transmission*.

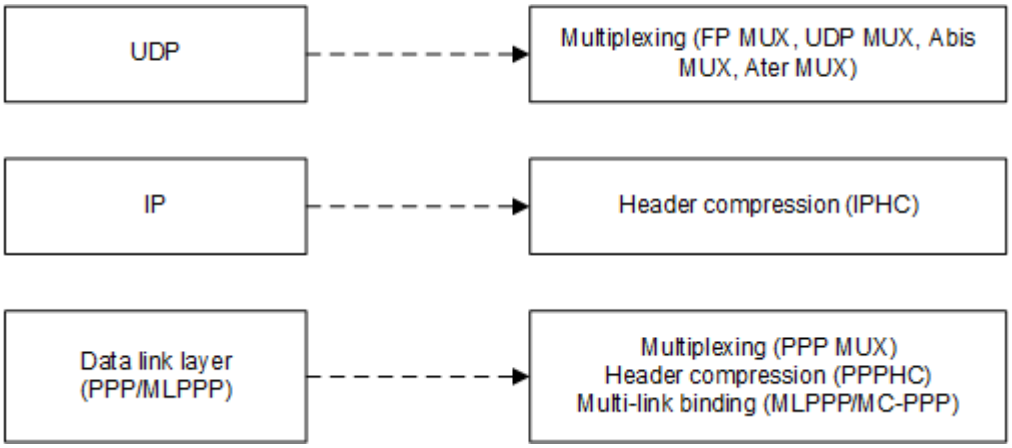
3 Overview

Transmission efficiency improvement is necessary in today's networks with ever-increasing traffic volume to increase their transmission bandwidth usage.

The IP transmission bandwidth usage can be increased by using multiplexing and header compression technologies that reduce the header overhead of packets.

Different mechanisms for improving IP transmission efficiency are provided based on the characteristics of the protocols, as shown in **Figure 3-1**.

Figure 3-1 Mechanisms for improving IP transmission efficiency



4 Multiplexing

4.1 Overview

Multiplexing (MUX) reduces the header overhead of packets by multiplexing multiple packets into one packet to improve transmission efficiency.

Multiplexing technologies include:

- FP MUX
- UDP MUX
- Abis MUX
- Ater MUX
- PPP MUX

Multiplexing may result in delay and jitter. Therefore, multiplexing is not recommended when bandwidth resources are sufficient.

4.2 FP MUX (Supported Only by UMTS)

4.2.1 Principles

Frame processing multiplexing (FP MUX) encapsulates multiple FP PDUs into one FP MUX packet, reducing the UDP/IP/L2/L1 header transmission overhead and improving transmission efficiency.

FP MUX has the following characteristics:

- The implementation is simple. UDP MUX requires support only at the transmit end and the receive end. The intermediate transmission equipment does not need to support UDP MUX.
- UDP MUX significantly improves the transmission efficiency but increases the transmission delay.
- FP MUX is not an open standard, which is not conducive to interface openness.

FP MUX is applicable only to the user plane of the Iub interface that is based on IP transmission. The BSC6900, BSC6910, and NodeB support this function.

NOTE

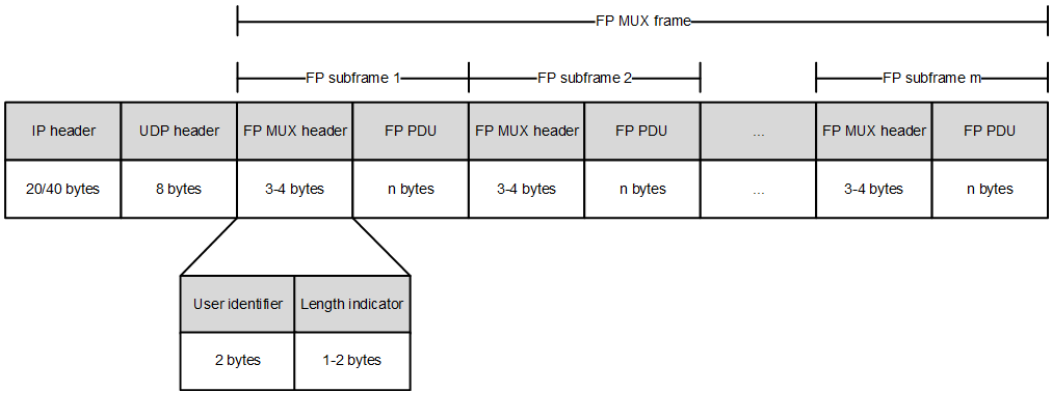
This function is not supported when the transmission link uses the endpoint configuration mode.

Packet Format

Figure 4-1 shows the format of an IP packet where FP MUX is applied. A multiplexed IP packet has the following characteristics:

- The FP PDUs in one FP MUX frame share the IP and UDP headers and therefore must have the same source IP address, destination IP address, and DSCP value.
- One FP MUX frame can carry the data of multiple users. The FP MUX header specifies the size and owner of each FP PDU.
- The UDP header contains a fixed source UDP port number. The number indicates that this packet is an FP MUX packet and therefore requires demultiplexing at the receive end.

Figure 4-1 Format of an FP MUX IP packet



The fields in Figure 4-1 are described as follows:

- User Identifier: specifies the owner of an FP PDU.
- Length Indicator: specifies the size of an FP PDU.
- FP PDU: is the payload of an FP subframe.

The parameters related to FP MUX are as follows:

- **FP MUX switch**: specifies whether to enable FP MUX.
- **Max subframe length[byte]**: specifies the maximum size of an FP subframe. If the size of an FP subframe exceeds the value of this parameter, the FP subframe is not multiplexed.
- **Max frame length[byte]**: specifies the maximum size of an FP MUX frame.
- **Max delay time[ms]**: specifies the maximum period of time that the system waits before sending the multiplexed data. If the waiting time exceeds the value of this parameter, the system immediately sends the multiplexed data to prevent a long delay.
- **IP MUX Demultiplexing Switch**: specifies whether to enable the IP MUX demultiplexing function.

NE	FP MUX Switch	IP MUX Demultiplexing Switch	Max Subframe Length	Maximum Frame Length	Maximum Delay
RNC	Set ***MUXTYPE*** to **FPMUX** to enable the FP MUX function.	-	***SUBFRAMELEN***	***MAXFRAMELEN***	***FPTIMER***
NodeB	Set ***IPMUXSWITCH*** to **ENABLE** to enable the FP MUX function.	Set ***IPMUXDEMULTIPLEXSW*** to **ENABLE** to enable the IP MUX demultiplexing function	***SUBFRAMELEN*** (**ADD IPPATH**)	***FRAMELEN*** (**ADD IPPATH**)	***TIMER*** (**ADD IPPATH**)

NOTE

To enable FP MUX on the RNC side, ***MUXTYPE*** on the RNC side and ***IPMUXDEMULTIPLEXSW*** on the NodeB side must be set to **FPMUX** and **ENABLE** at the same time, respectively.

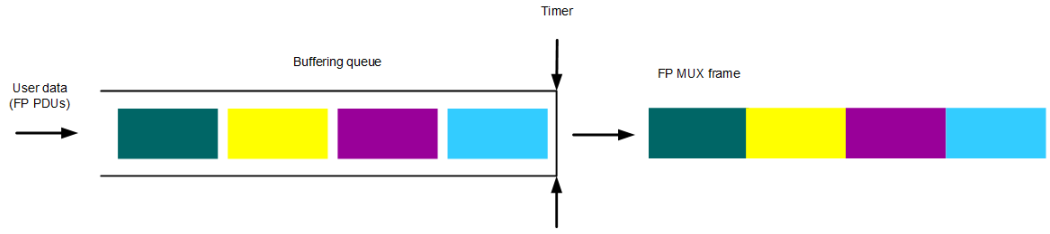
Principles

The prerequisites for enabling FP MUX are as follows:

- Both the RNC and the NodeB support FP MUX.
- The data related to FP MUX is configured on both the RNC and NodeB sides.

Figure 4-2 shows the working principle of FP MUX at the transmit end.

Figure 4-2 Buffering and multiplexing performed at the transmit end



The transmit end buffers the user data (FP PDUs) and encapsulates the data into FP MUX frames according to specific multiplexing conditions. Then, the FP MUX frames are sent to the UDP layer.

The multiplexing conditions are as follows:

- If the size of an FP PDU exceeds the maximum subframe length, the FP PDU is not multiplexed but directly sent to the UDP layer.
- If the size of an FP MUX frame reaches the maximum frame length, the FP MUX frame is sent to the UDP layer without being multiplexed with more FP PDUs.

- If the timer reaches the maximum multiplexing delay time, the FP MUX frame is sent to the UDP layer without being multiplexed with more FP PDUs.

After receiving the FP MUX frames in sequence, the receive end demultiplexes the frames to obtain the original data and perform service processing.

4.2.2 Network Analysis

4.2.2.1 Benefits

FP MUX significantly improves the transmission efficiency.

The voice service is used as an example. The size of each voice packet is 41 bytes, and the total size of the IP and UDP headers is 28 bytes. If FP MUX is not applied, the size of the IP packet is 69 bytes (28 bytes + 41 bytes). If FP MUX is applied, the transmission efficiency is improved because the ratio of the UDP data size to the IP packet size increases from 60% to 70% or even to 90% when the number of FP subframes in the FP MUX frame increases. The ratio equals (41 x n) divided by [28 + (41 + 3) x n], where n equals (1, 2,...). However, when the overheads of the IP and UDP packet headers decrease, the transmission delay increases.

4.2.2.2 Impacts

Network Impacts

None

Function Impacts

RAT	Function Name	Function Switch	Reference	Description
UMTS	Iub Transmission Resource Pool in RNC	None	*Transmission Resource Pool in RNC*	● When FP MUX is used, an RNC pool supports only one IP address. NodeBs are interconnected to the RNC using IP paths. ● When Transmission Resource Pool in RNC is used, an RNC pool supports multiple IP addresses. This enables traffic data to be transmitted on different transmission paths to implement load balancing. However, FP MUX enables traffic data to converge on one

RAT	Function Name	Function Switch	Reference	Description
UMTS	Iub IP Transmission Based on Dynamic Load Balance	None	*Transmission Resource Pool in RNC*	transmission path and multiplexes traffic packets of the same type to one packet for transmission, which reduces the transmission overhead. Therefore, Transmission Resource Pool in RNC and FP MUX cannot be used at the same time.

4.2.3 Requirements

4.2.3.1 Licenses

The following licenses for FP MUX for IP Transmission must be purchased and activated for the RNC.

Feature ID	Feature Name	Model	License Control Item Name	NE	Sales Unit
WRFD-050420	FP MUX for IP Transmission	LQW1FPMUX01RESE	FP MUX for IP Transmission	BSC6900 BSC6910	Erl
WRFD-050420	FP MUX for IP Transmission	LQW1FPMUX01RESM	FP MUX for IP Transmission	BSC6900 BSC6910	Mbps

4.2.3.2 Software

Prerequisite Functions

RAT	Function Name	Function Switch	Reference	Description
UMTS	IP Transmission Introduction on Iub Interface	None	*IPv4 Transmission*	-

Mutually Exclusive Functions

None

4.2.3.3 Hardware

Base Station Models

The following base stations are compatible with this function:

- 3900 and 5900 series base stations
- DBS3900 LampSite and DBS5900 LampSite
- BTS3911E

Boards

RNC:

- The FG2a, FG2c, FG2e, GOUa, GOUc, and POUc of the BSC6900 support this feature.
- The FG2c, FG2e, GOUc, EXOUa, and EXOUb of the BSC6910 support this feature.

NodeB:

- The UTRP, UTRPc, UMPT, and WMPT of the BTS3900 and BTS5900 support this feature.

RF Modules

N/A

4.2.3.4 Networking

The Iub interface uses IP transmission.

4.2.3.5 Others

The receive end of IP packets support FP MUX.

4.2.4 Operation and Maintenance

4.2.4.1 When to Use

It is recommended that FP MUX be activated in the following scenarios:

- The Iub interfaces are interconnected through the bearer network, and the bandwidth of the bearer network is insufficient.
- The transmission performance of the bearer network is good. For the IP bearer network, the packet loss rate is low. For the SDH/MSTP network, the bit error rate is low.

Since FP MUX may cause delay and jitter, it is not recommended that this feature be activated if the bandwidth of the Iub interface is sufficient.

4.2.4.2 Data Configuration

4.2.4.2.1 Data Preparation

The following table describes the key data that must be set in an **IPMUX** MO in non-transmission-resource-pool networking, and in an **IPPOOLMUX** MO in transmission resource pool networking, to configure FP MUX for IP transmission on the RNC side.

Table 4-1 Data to prepare before activating FP MUX in non-transmission-resource-pool networking (RNC)

Parameter Name	Parameter ID	Setting Notes
IP MUX Type	**IPMUX.*MUXTYPE***	FPMUX
Max subframe length[byte]	**IPMUX.*SUBFRAMELEN***	The default value is 352. To ensure that a specific subframe can be multiplexed, the value of this parameter must be greater than the length of the subframe. If a specific subframe does not need to be multiplexed to reduce the delay, ensure that the value of this parameter is less than the length of the subframe.
Maximum Frame Length[byte]	**IPMUX.*MAXFRAMELEN***	The default value is 1031. If the length of a multiplexed frame is greater than the value of the ***MTU*** parameter (set by running the **SET ETHPORT** command), the multiplexed frame will be fragmented. To avoid this situation, modify the value of this parameter.
Maximum Delay Time[ms]	**IPMUX.*FPTIMER***	The default value is 2. Increasing this parameter value leads to a higher multiplexing rate, but also a larger delay and jitter.

Table 4-2 Data to prepare before activating FP MUX in transmission resource pool networking (RNC)

Parameter Name	Parameter ID	Setting Notes
MUX Type	**IPPOOLMUX**.***MUXTYPE***	FPMUX
Max subframe length[byte]	**IPPOOLMUX.*SUBFRAMELEN***	The default value is 352. To ensure that a specific subframe can be multiplexed, the value of this parameter must be greater than the length of the subframe. If a specific subframe does not need to be multiplexed to reduce the delay, ensure that the value of this parameter is less than the length of the subframe.
Maximum Frame Length[byte]	**IPPOOLMUX**.***MAXFRAMELEN***	The default value is 1031. If the length of a multiplexed frame is greater than the value of the ***MTU*** parameter (set by running the **SET ETHPORT** command), the multiplexed frame will be fragmented. To avoid this situation, modify the value of this parameter.
Maximum Delay Time[ms]	**IPPOOLMUX**.***FPTIMER***	The default value is 2. Increasing this parameter value leads to a higher multiplexing rate, but also a larger delay and jitter.

NOTE

You do not need to configure the number of packets to be multiplexed after feature activation. This is because the RNC selects appropriate subframes within the maximum multiplexing delay duration. Subframes that meet the following conditions will be combined into a packet:

- The sending of a subframe is within the maximum multiplexing delay duration.
- The size of a subframe is less than the maximum subframe length.
- The total size of the subframes plus 8 is less than or equal to the maximum multiplexing frame length.

The following table describes the parameters that must be set in an **IPPATH** MO and a **TRANSFUNCTIONSW** MO to configure FP MUX for IP transmission and IP MUX Demultiplexing, respectively on the NodeB side.

Table 4-3 Data to prepare before activating FP MUX (NodeB)

Parameter Name	Parameter ID	Setting Notes
IP MUX Switch	**IPPATH.*IPMUXSWITCH***	ENABLE(Enable)
Max Subframe Length	**IPPATH.*SUBFRAMELEN***	127

Parameter Name	Parameter ID	Setting Notes
Max Frame Length	**IPPATH.*FRAMELEN***	270
Max Timer	**IPPATH.*TIMER***	1
IP MUX Demultiplexing Switch	**TRANSFUNCTIONSW.*IPMUXDEMULTIPLEXSW***	ENABLE(Enable)

4.2.4.2.2 Using MML Commands

Activation Command Examples

When the old transmission configuration model is used (**GTRANSPARA.*TRANSCFGMODE*** is set to **OLD**):

```
//Activating FP MUX for IP Transmission on the RNC side
//When no transmission resource pools are configured on the RNC side:
ADD IPMUX: MUXTYPE=FPMUX,
ANI=1,PATHID=1,ISQOSPATH=NO,SUBFRAMELEN=352,MAXFRAMELEN=1031,FPTIMER=2;
//When transmission resource pools are configured on the RNC side:
ADD IPPOOLMUX: MUXTYPE=
FPMUX,ANI=1,PHB=BE,SUBFRAMELEN=352,MAXFRAMELEN=1031,FPTIMER=2,IPPOOLMUXINDEX=1;
//On the NodeB side:
SET TRANSFUNCTIONSW: IPMUXDEMULTIPLEXSW= ENABLE;
//Activating FP MUX for IP Transmission on the NodeB side
ADD IPPATH:
PATHID=0,CN=0,SRN=0,SN=6,SBT=BASE_BOARD,PT=PPP,PN=0,JNRSCGRP=ENABLE,RSCGRPID=0,LOC
ALIP="192.168.11.110",PEERIP="192.168.22.220",DSCP=20,IPMUXSWITCH=ENABLE,SUBFRAMEL
EN=128,FRAMELEN=512,TIMER=2;
```

When the new transmission configuration model is used (**GTRANSPARA.*TRANSCFGMODE*** is set to **NEW**):

```
//Activating FP MUX for IP Transmission on the RNC side
//When no transmission resource pools are configured on the RNC side:
ADD IPMUX: MUXTYPE=FPMUX,
ANI=1,PATHID=1,ISQOSPATH=NO,SUBFRAMELEN=352,MAXFRAMELEN=1031,FPTIMER=2;
//When transmission resource pools are configured on the RNC side:
ADD IPPOOLMUX: MUXTYPE=
FPMUX,ANI=1,PHB=BE,SUBFRAMELEN=352,MAXFRAMELEN=1031,FPTIMER=2,IPPOOLMUXINDEX=1;
//On the NodeB side:
SET TRANSFUNCTIONSW: IPMUXDEMULTIPLEXSW= ENABLE;
//Activating FP MUX for IP Transmission on the NodeB side
ADD IPPATH: PATHID=0, TRANSCFGMODE=NEW, JNIPRSCGRP= DISABLE, BPT= PPP, PORTID=0,
LOCALIP="192.168.11.110", PEERIP="192.168.22.220", PATHTYPE=FIXED,
DSCP=20,IPMUXSWITCH=ENABLE,SUBFRAMELEN=128,FRAMELEN=512,TIMER=2;
```

Deactivation Command Examples

When the old transmission configuration model is used (**GTRANSPARA.*TRANSCFGMODE*** is set to **OLD**):

```
//Deactivating FP MUX on the RNC side when no transmission resource pools are
configured
RMV IPMUX: IPMUXINDEX=1;
//Deactivating FP MUX on the RNC side when transmission resource pools are
```



```
configured
RMV IPPOOLMUX: IPPOOLMUXINDEX=1;
//Deactivating FP MUX on the NodeB side
MOD IPPATH: PATHID=1, SN=1, PATHTYPE=FIXED, IPMUXSWITCH=DISABLE;
```

When the new transmission configuration model is used (**GTRANSPARA.*TRANSCFGMODE*** is set to **NEW**):

```
//Deactivating FP MUX on the RNC side when no transmission resource pools are
configured
RMV IPMUX: IPMUXINDEX=1;
//Deactivating FP MUX on the RNC side when transmission resource pools are
configured
RMV IPPOOLMUX: IPPOOLMUXINDEX=1;
//Deactivating FP MUX on the NodeB side
MOD IPPATH: PATHID=1, TRANSCFGMODE=NEW, PATHTYPE=FIXED, IPMUXSWITCH=DISABLE;
```

4.2.4.2.3 Using the CME

For detailed operations, see CME-based Feature Configuration.

4.2.4.3 Activation Verification

Step 1 Run the RNC MML command **DSP IPMUX** (when no transmission resource pools are configured) or **DSP IPPOOLMUX** (when transmission resource pools are configured) to query the status and performance of IP packet multiplexing.

Step 2 Run the NodeB MML command **DSP IPPATH** to check whether **IP MUX Switch** is set to **ENABLE(Enable)** for a specified IP path.

----End

4.2.4.4 Network Monitoring

None

4.3 UDP MUX (Supported Only by GSM and UMTS)

4.3.1 Principles

UDP multiplexing (UDP MUX) is a transport bearer multiplexing technology defined in 3GPP TR 29.814. It is also called RTP MUX. This technology enables multiple RTP packets to be multiplexed in one UDP packet, reducing the overhead of the UDP/IP/L2/L1 header and increasing the transmission efficiency.

UDP MUX has the following characteristics:

- The implementation is simple. UDP MUX requires support only at the transmit end and the receive end. The intermediate transmission equipment does not need to support UDP MUX.
- UDP MUX significantly improves the transmission efficiency but increases the transmission delay.
- UDP MUX is an open standard.

UDP MUX is applicable to the user plane of the A and Iu-CS interfaces that are based on IP transmission. The BSC6900 and BSC6910 support UDP MUX.

Packet Format

UDP MUX has two multiplexing modes:

- Multiplexing mode 1: In this mode, RTP packets are multiplexed without being compressed.

  The size of an RTP header is 12 bytes. **Figure 4-3** shows the IP packet format with the RTP header uncompressed.

- Multiplexing mode 2: In this mode, the RTP header is compressed and then multiplexed.

  The field that remains unchanged during a call is removed from the RTP header, and only the variable Sequence Number and Timestamp fields are reserved. The size of the RTP header after compression is 3 bytes (UMTS) or 4 bytes (GSM). **Figure 4-4** shows the IP packet format with the RTP header compressed.

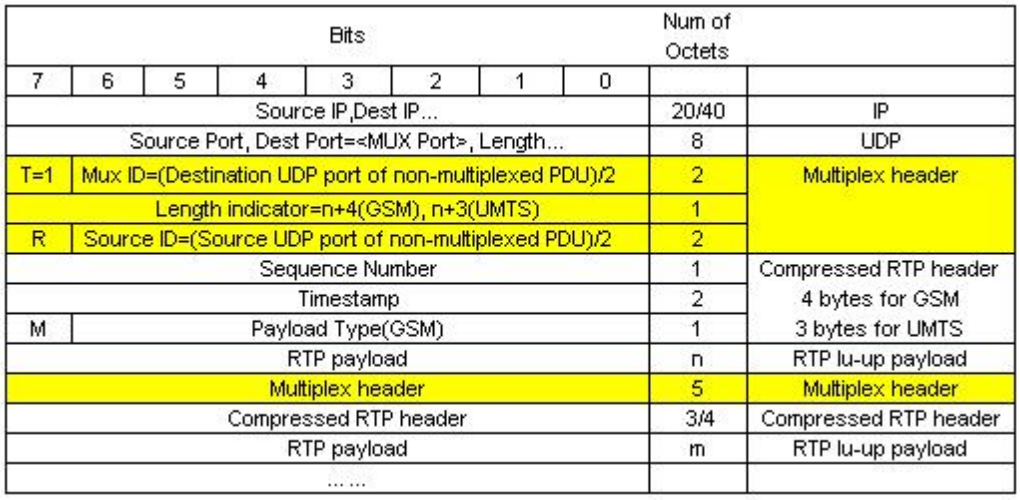
UDP MUX packets have the following characteristics:

- The RTP packets in one UDP MUX packet share the IP and UDP headers and therefore must have the same source IP address, destination IP address, and DSCP.
- A UDP MUX packet can carry the data of different users. The Multiplex header specifies the size and owner of each RTP packet.
- The UDP header contains a fixed source UDP port number. The number indicates that this packet is a UDP MUX packet and therefore requires demultiplexing at the receive end.

Figure 4-3 IP packet format with the RTP header uncompressed

<table>
<tr><th colspan="8">Bits</th><th>Num of Octets</th><th></th></tr>
<tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td><td></td><td></td></tr>
<tr><td colspan="8">Source IP,Dest IP...</td><td>20/40</td><td>IP</td></tr>
<tr><td colspan="8">Source Port, Dest Port=<MUX Port>, Length...</td><td>8</td><td>UDP</td></tr>
<tr><td>T=0</td><td colspan="7">Mux ID=(Destination UDP port of non-multiplexed PDU)/2</td><td>2</td><td rowspan="3">Multiplex header</td></tr>
<tr><td colspan="8">Length indicator=n+12</td><td>1</td></tr>
<tr><td>R</td><td colspan="7">Source ID=(Source UDP port of non-multiplexed PDU)/2</td><td>2</td></tr>
<tr><td colspan="8" rowspan="2">Full RTP packet</td><td>12</td><td>RTP header</td></tr>
<tr><td>n</td><td>RTP Iu-up payload</td></tr>
<tr><td colspan="8">Multiplex header</td><td>5</td><td>Multiplex header</td></tr>
<tr><td colspan="8" rowspan="2">Full RTP packet</td><td>12</td><td>RTP header</td></tr>
<tr><td>m</td><td>RTP Iu-up payload</td></tr>
<tr><td colspan="8">.....</td><td></td><td></td></tr>
</table>

Figure 4-4 IP packet format with the RTP header compressed



Bits								Num of Octets	
7	6	5	4	3	2	1	0		
Source IP,Dest IP...								20/40	IP
Source Port, Dest Port=<MUX Port>, Length...								8	UDP
T=1	Mux ID=(Destination UDP port of non-multiplexed PDU)/2							2	Multiplex header
Length indicator=n+4(GSM), n+3(UMTS)								1	
R	Source ID=(Source UDP port of non-multiplexed PDU)/2							2	
Sequence Number								1	Compressed RTP header
Timestamp								2	4 bytes for GSM
M	Payload Type(GSM)							1	3 bytes for UMTS
RTP payload								n	RTP Iu-up payload
Multiplex header								5	Multiplex header
Compressed RTP header								3/4	Compressed RTP header
RTP payload								m	RTP Iu-up payload
... ...									

The following describes the fields of a UDP MUX packet.

- T: specifies whether the RTP header is compressed. Value **0** indicates that the RTP header is not compressed, and value **1** indicates that the RTP header is compressed.
- Mux ID: is used in combination with the Source ID field to identify a user-plane connection. The value of this field is equal to the destination UDP port number of the RTP packet divided by two.
- Length indicator: specifies the size of a multiplexed RTP packet, including the size of the RTP header and payload. This field gives the information where the next multiplexed RTP packet starts.
- R: reserved extension bit. This field is set to **0**.
- Source ID: is used in combination with the Mux ID field to identify a user-plane connection. The value of this field is equal to the source UDP port number of the RTP packet divided by two.
- Sequence Number: specifies the sequence number of an RTP packet.
- Timestamp: specifies the time point when an RTP packet is sent.
- Payload Type: specifies the type of the payload.

In non-transmission resource pool networking, the **ADD IPMUX** command is used to configure the multiplexing function for data flows on the specified IP path.

In transmission resource pool networking, the **ADD IPPOOLMUX** command is used to enable the multiplexing function for the specified "adjacent node+PHB". This function enables multiplexing for data flows on the link between the base station controller and the corresponding adjacent node based on the PHB.

The related parameters on the base station controller are as follows:

- The following three parameters need to be set to enable UDP MUX:
  - Any of the following parameters: specifies whether UDP MUX is enabled on the base station controller side. When any of the parameters is set to **UDPMUX**, UDP MUX is enabled.
    - ***MUXTYPE*** when no transmission resource pools are configured

  - **MUXTYPE** when transmission resource pools are configured
- ***UDPMUXMODSEND***: specifies the UDP MUX mode of the base station controller when it transmits data. The value of this parameter can be **NORTPCOMP** or **RTPCOMP**. If this parameter is set to **NORTPCOMP**, the base station controller supports UDP MUX with uncompressed RTP headers when transmitting data. If this parameter is set to **RTPCOMP**, the base station controller supports UDP MUX with compressed RTP headers when transmitting data.
- ***UDPMUXMODRECV***: specifies the UDP MUX mode of the base station controller when it receives data. The value of this parameter can be **NORTPCOMP** or **RTPCOMP**. If this parameter is set to **NORTPCOMP**, the base station controller supports UDP MUX with uncompressed RTP headers when receiving data. If this parameter is set to **RTPCOMP**, the base station controller supports UDP MUX with compressed RTP headers when receiving data.

- ***SUBFRAMELEN***: specifies the maximum size of an RTP packet that can be multiplexed. If the size of an RTP packet exceeds the value of this parameter, the RTP packet is transmitted without being multiplexed.
- ***MAXFRAMELEN***: specifies the maximum size of a UDP MUX packet. If the size of a UDP MUX packet exceeds the value of this parameter, the packet is transmitted without being added with more packets.
- ***FPTIMER***: specifies the maximum period of time that the system waits before sending the multiplexed data. If the waiting time exceeds the value of this parameter, the system immediately sends the multiplexed data to prevent a long delay.

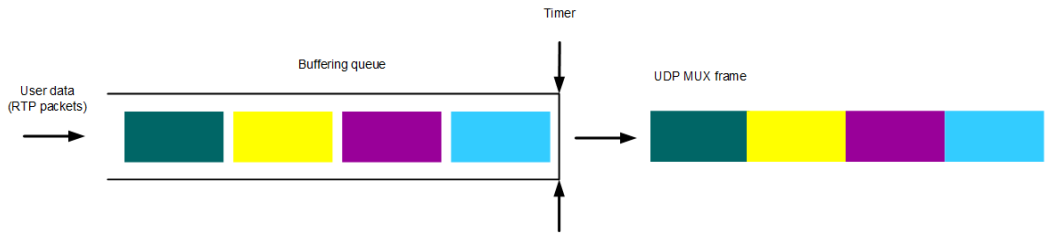
Working Principle

The prerequisites for enabling UDP MUX are as follows:

- Both the BSC/RNC and MGW support UDP MUX.
- The data related to UDP MUX is configured on both the BSC/RNC and MGW sides.

Figure 4-5 shows the working principle of UDP MUX at the transmit end.

Figure 4-5 Buffering and multiplexing performed at the transmit end



The transmit end buffers the user data and encapsulates multiple RTP packets into one UDP MUX packet according to specific multiplexing conditions.

The multiplexing conditions are as follows:

- If the length of a UDP MUX packet reaches the value of ***MAXFRAMELEN***, the UDP MUX packet is sent without being multiplexed with more RTP packets.
- If the timer reaches the value of ***FPTIMER***, the UDP MUX packet is sent without being multiplexed with more RTP packets.

After receiving the UDP MUX packets in sequence, the receive end demultiplexes the packets to obtain the original data and perform service processing.

4.3.2 Network Analysis

4.3.2.1 Benefits

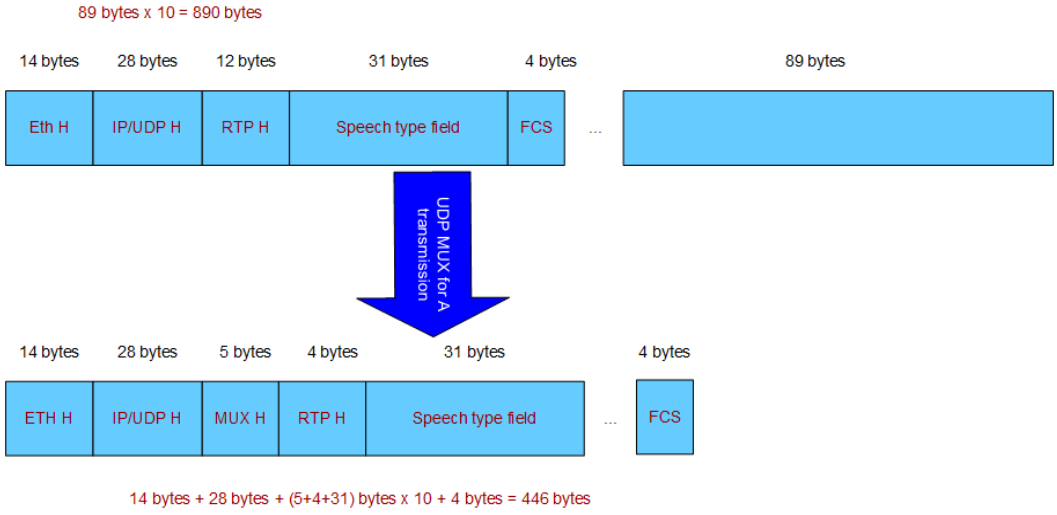
UDP multiplexing improves transmission efficiency.

As shown in **Figure 4-3** and **Figure 4-4**, when k RTP packets are multiplexed into one UDP packet, the IP packet overhead is reduced. When the RTP header is not compressed, an overhead of (23 x k – 28) bytes is saved. When the RTP header is compressed, an overhead of (32 x k – 28) bytes is saved. In addition, the total L2 and L1 header overhead decreases with the reducing number of packets. Therefore, the multiplexing efficiency is significantly improved. For detailed analysis, see 3GPP TR 29.814.

More multiplexed frames lead to higher transmission efficiency.

Figure 4-6 shows the frame format before and after this feature is enabled, using EFR speech packets with the RTP header being compressed as an example.

Figure 4-6 Frame format before and after UDP MUX for A Transmission is enabled



As shown in the preceding figure, before this feature is enabled, the sizes of the Ethernet header, IP/UDP header, RTP header, speech type field, and FCS for a frame are 14, 28, 12, 31, and 4 bytes, respectively. Therefore, the size of a frame is 89 bytes and the total size of 10 frames is 890 bytes.

After this feature is enabled, 10 frames are multiplexed. The sizes of the Ethernet header, IP/UDP header, multiplexed header, RTP header, speech type field, and FCS for a frame are reduced to 14, 28, 5, 4, 31, and 4 bytes, respectively. The formula for calculating the total size of these multiplexed frames is as follows: 14 bytes + 28 bytes + (5 bytes + 4 bytes + 31 bytes) x 10 + 4 bytes = 446 bytes

After this feature is enabled, transmission efficiency increases from 34.83% to 69.50%.

- Transmission efficiency before the multiplexing: 31/89 = 34.83%

- Transmission efficiency after the multiplexing: 31/44.6 = 69.50%

4.3.2.2 Impacts

Network Impacts

- WRFD-050412 UDP MUX for Iu-CS Transmission has no impact on the network.
- GBFD-118610 UDP MUX for A Transmission does not affect the system capacity but affects the transmission efficiency on the A interface.

  When there is a bit error, enabling this feature has a negative impact on speech quality. The impact can be minimized by reducing the value of the parameter related to multiplexing duration or by reducing the size of the frames to be multiplexed.

Function Impacts

None

4.3.3 Requirements

4.3.3.1 Licenses

The following licenses for the UDP MUX for A Transmission and UDP MUX for Iu-CS Transmission features must be purchased and activated for the BSC/RNC.

Feature ID	Feature Name	Model	License Control Item Name	NE	Sales Unit
GBFD-118610	UDP MUX for A Transmission	LGMIUDPMUX	UDP MUX for A Transmission	BSC6900 BSC6910	Erl
WRFD-050412	UDP MUX for Iu-CS Transmission	LQW1UDPMUX01RES	UDP MUX for Iu-CS Transmission	BSC6900 BSC6910	Erl

4.3.3.2 Software

Prerequisite Functions

- Prerequisite functions for GBFD-118610 UDP MUX for A Transmission

RAT	Function Name	Function Switch	Reference	Description
GSM	A over IP	None	*IPv4 Transmission*	-

RAT	Function Name	Function Switch	Reference	Description
GSM	A IP over E1/T1	None	*IPv4 Transmission*	-

- Prerequisite functions for WRFD-050412 UDP MUX for Iu-CS Transmission

RAT	Function Name	Function Switch	Reference	Description
UMTS	IP Transmission Introduction on Iu Interface	None	*IPv4 Transmission*	-

Mutually Exclusive Functions

None

4.3.3.3 Hardware

Base Station Models

The following base stations are compatible with this function:

3900 and 5900 series base stations

Boards

- UDP MUX for A Transmission
  - IP over Ethernet

    The BSC6900 must be configured with the FG2a/FG2c/FG2d/FG2e/GOUa/GOUc/GOUd board.

    The BSC6910 must be configured with the FG2c/FG2d/FG2e/GOUc/GOUd/EXOUa/EXOUb board.
  - IP over E1/T1

    The BSC6900 must be configured with the POUc/PEUa/PEUc board.
- UDP MUX for Iu-CS Transmission
  - IP over Ethernet

    The BSC6900 must be configured with the FG2a/FG2c/FG2e/GOUa/GOUc board.

    The BSC6910 must be configured with the FG2c/FG2e/GOUc/EXOUa/EXOUb board.
  - IP over E1/T1

    The BSC6900 must be configured with the POUc board.

RF Modules

N/A

4.3.3.4 Networking

The A and Iu-CS interfaces use IP transmission.

Transmission bandwidth is properly planned.

4.3.3.5 Others

The CN supports UDP MUX.

4.3.4 Operation and Maintenance

4.3.4.1 When to Use

Use UDP MUX in the following scenarios:

- The IP-based A interface and Iu-CS interface are interconnected through the bearer network, of which the bandwidth is insufficient.
- The transmission performance of the bearer network is good. For the IP bearer network, the packet loss rate is low. For the SDH/MSTP network, the BER is low.

UDP MUX is not recommended in the following scenarios:

- The BER is higher than 10^{-6} in SDH networking scenarios.
- The IP transmission quality (delay or packet loss rate) is close to the tolerable transmission QoS value required in IP transmission scenarios.

Since UDP MUX may cause delay and jitter, it is not recommended that UDP MUX be activated if the BSC/RNC and the CN equipment are located in the same equipment room.

4.3.4.2 Data Configuration

4.3.4.2.1 Data Preparation

For the data to prepare before activating UDP MUX, see **Table 4-1**.

The following table describes the key data that must be set in an **IPMUX** MO in non-transmission-resource-pool networking, and in an **IPPOOLMUX** MO in transmission resource pool networking, to configure UDP MUX for IP transmission on the BSC side.

Table 4-4 Data to prepare before activating UDP MUX in non-transmission-resource-pool networking (BSC)

Parameter Name	Parameter ID	Setting Notes
IP MUX Type	**IPMUX.*MUXTYPE***	UDPMUX

Parameter Name	Parameter ID	Setting Notes
Max subframe length[byte]	**IPMUX.*SUBFRAMELEN***	352
Maximum Frame Length[byte]	**IPMUX.*MAXFRAMELEN***	1031
Maximum Delay Time[ms]	**IPMUX.*FPTIMER***	2

Table 4-5 Data to prepare before activating UDP MUX in transmission resource pool networking (BSC)

Parameter Name	Parameter ID	Setting Notes
MUX Type	**IPPOOLMUX.*MUXTYPE***	UDPMUX
Max subframe length[byte]	**IPPOOLMUX.*SUBFRAMELEN***	352
Maximum Frame Length[byte]	**IPPOOLMUX.*MAXFRAMELEN***	1031
Maximum Delay Time[ms]	**IPPOOLMUX.*FPTIMER***	2

NOTE

In non-transmission resource pool networking, the ***FPTIMER*** and ***MAXFRAMELEN*** parameters are used. In transmission resource pool networking, the ***FPTIMER*** and ***MAXFRAMELEN*** parameters are used.

- If transmission quality is poor, for example, bit errors occur, decrease parameter values to improve service quality.
- If transmission quality is good but transmission bandwidth resources are insufficient, increase parameter values to save transmission bandwidth.
- If the transmission quality of CS services is poor and the PS data rate is low, you can infer that bit errors occur. In this case, it is recommended that parameter values be decreased to minimize the impact of high BER.
- If the transmission quality of CS services is favorable and the PS data rate is low, you can infer that transmission congestion occurs. It is recommended that parameter values be increased to relieve transmission congestion.

Transmission quality of CS services is indicated by the voice quality during calls. Transmission quality of PS services is indicated by the PS data rate.

4.3.4.2.2 Using MML Commands

Activation Command Examples

```
//Activating UDP MUX for the A or Iu-CS interface when no transmission resource
pools are configured. To activate UDP MUX for multiple links, run the following
command for each link you want to activate.
ADD
IPMUX:MUXTYPE=UDPMUX,ANI=0,PATHID=0,ISQOSPATH=NO,SUBFRAMELEN=352,MAXFRAMELEN=1031,
FPTIMER=2,UDPMUXMODSEND=RTPCOMP,UDPMUXMODRECV=RTPCOMP,IPMUXINDEX=0;
//Activating UDP MUX for the A or Iu-CS interface when transmission resource
pools are configured. To activate UDP MUX for multiple adjacent nodes, run the
following command for each link you want to activate.
ADD
IPPOOLMUX:MUXTYPE=UDPMUX,ANI=0,PHB=AF33,SUBFRAMELEN=352,MAXFRAMELEN=1031,FPTIMER=2
,UDPMUXMODSEND=RTPCOMP,UDPMUXMODRECV=RTPCOMP,IPPOOLMUXINDEX=0;
```

NOTE

If no transmission resource pools are configured, IP paths must be configured based on the network plan. If transmission resource pools are configured, correct adjacent nodes must be configured based on the network plan.

The BSC/RNC assigns a default **IPMUXINDEX** value, but this parameter can also be set manually.

The RTCP function is enabled. To enable the function for GSM, run the BSC MML command **ADD GCNNODE** or **MOD GCNNODE** with **RTCPSWITCH** set to **ON**. To enable the function for UMTS, run the RNC MML command **ADD UCNNODE** or **MOD UCNNODE** with **RTCPSwitch** set to **ON**.

Deactivation Command Examples

```
//Deactivating UDP MUX
//When no transmission resource pools are configured
RMV IPMUX: IPMUXINDEX=0;
//When transmission resource pools are configured
RMV IPPOOLMUX: IPPOOLMUXINDEX=0;
```

4.3.4.2.3 Using the CME

For detailed operations, see CME-based Feature Configuration.

4.3.4.3 Activation Verification

- When no transmission resource pools are configured, run the BSC/RNC MML command **DSP IPMUX** to query the statistics and status of IP packet multiplexing. Check whether the feature has been activated based on the values of the IP MUX status, number of packets after multiplexing, and number of multiplexed subframes parameters.
- When transmission resource pools are configured, run the BSC/RNC MML command **DSP IPPOOLMUX** to query the status of IP packet multiplexing. Check whether the feature has been activated based on the values of the IP MUX status, number of packets after multiplexing, and number of multiplexed subframes parameters.

4.3.4.4 Network Monitoring

None

4.4 Abis MUX and Ater MUX (Supported Only by GSM)

4.4.1 Principles

Abis MUX saves bandwidth by multiplexing packets. The BSC and BTS serve as transmit and receive ends for each other. When Abis MUX is enabled, the transmit end multiplexes the IP or UDP packets that meet the multiplexing requirements. Multiple IP or UDP packets are multiplexed into one IP or UDP header at the transmit end, and demultiplexed at the receive end to restore the original data in the IP/UDP packets. This improves transmission efficiency and saves transmission bandwidth.

The differences between Abis MUX and Ater MUX are as follows:

Abis MUX applies to the IP-based user plane for the Abis interface, whereas Ater MUX applies to the IP-based user plane for the Ater interface. The BSC6910 does not support Ater MUX.

This section describes the Ater MUX and Abis MUX mechanisms. The packet formats and working principles for Ater MUX and Abis MUX are the same as those for FP MUX. For details, see **4.2 FP MUX (Supported Only by UMTS)**.

When the BSC works in non-transmission-resource-pool networking mode, set ***MUXTYPE*** to **ABISMUX** to enable Abis MUX on the BSC. Other parameters are as follows:

- ***FPTIMER***: specifies the maximum period of time that the system waits before sending the multiplexed data. If the waiting time exceeds the value of this parameter, the system immediately sends the multiplexed data to prevent a long delay.
- ***ISQOSPATH***: specifies whether a path is a QoS path.
- ***MAXFRAMELEN***: specifies the maximum size of an Abis MUX frame.
- ***PHB***: specifies the PHB type of the IP MUX to be enabled.
- ***SUBFRAMELEN***: specifies the maximum size of an Abis subframe. If the size of an Abis subframe exceeds the value of this parameter, the Abis subframe is not multiplexed.

When the BSC works in transmission resource pool networking mode, set ***MUXTYPE*** to **ABISMUX** to enable Abis MUX on the BSC. Other parameters are as follows:

- ***PHB***: specifies the PHB type of the IP MUX to be enabled.
- ***SUBFRAMELEN***: specifies the maximum size of an Abis subframe. If the size of an Abis subframe exceeds the value of this parameter, the Abis subframe is not multiplexed.
- ***FPTIMER***: specifies the maximum period of time that the system waits before sending the multiplexed data. If the waiting time exceeds the value of this parameter, the system immediately sends the multiplexed data to prevent a long delay.
- ***MAXFRAMELEN***: specifies the maximum size of an Abis MUX frame.

Set ***IPMUXSWITCH*** to **ENABLE** to enable Abis MUX on the eGBTS. Other parameters are as follows:

- ***TIMER***: specifies the maximum period of time that the system waits before sending the multiplexed data. If the waiting time exceeds the value of this parameter, the system immediately sends the multiplexed data to prevent a long delay.
- ***FRAMELEN***: specifies the maximum size of an Abis MUX frame.
- ***SUBFRAMELEN***: specifies the maximum size of an Abis subframe. If the size of an Abis subframe exceeds the value of this parameter, the Abis subframe is not multiplexed.

The Abis MUX parameters on the GBTS side are as follows:

- ***SUBFRAMETHRES***: specifies the maximum size of an Abis subframe. If the size of an Abis subframe exceeds the value of this parameter, the Abis subframe is not multiplexed.
- ***PKTLENTHRES***: specifies the maximum size of an Abis MUX frame.

NOTE

When Abis MUX is enabled on the BSC, the IP MUX demultiplexing switch on the base station side must also be turned on. To turn on this switch, perform the following operations accordingly:

- For an eGBTS, run the **SET TRANSFUNCTIONSW** command with ***IPMUXDEMULTIPLEXSW*** set to **ENABLE(Enable)** on the BTS side.
- For a GBTS, run the **SET BTSGTRANSPARA** command with ***IPMUXDEMULTIPLEX*** set to **ENABLE** on the BSC side.

- ***TIMEOUT***: specifies the maximum period of time that the system waits before sending the multiplexed data. If the waiting time exceeds the value of this parameter, the system immediately sends the multiplexed data to prevent a long delay.
- ***SRVTYPE***: specifies the type of service for which multiplexing is performed. The service type can be CS speech service, CS data service, PS high-priority service, and PS low-priority service.

The Ater MUX parameter on the BSC6900 is as follows:

MUXTYPE: specifies whether to enable Ater MUX.

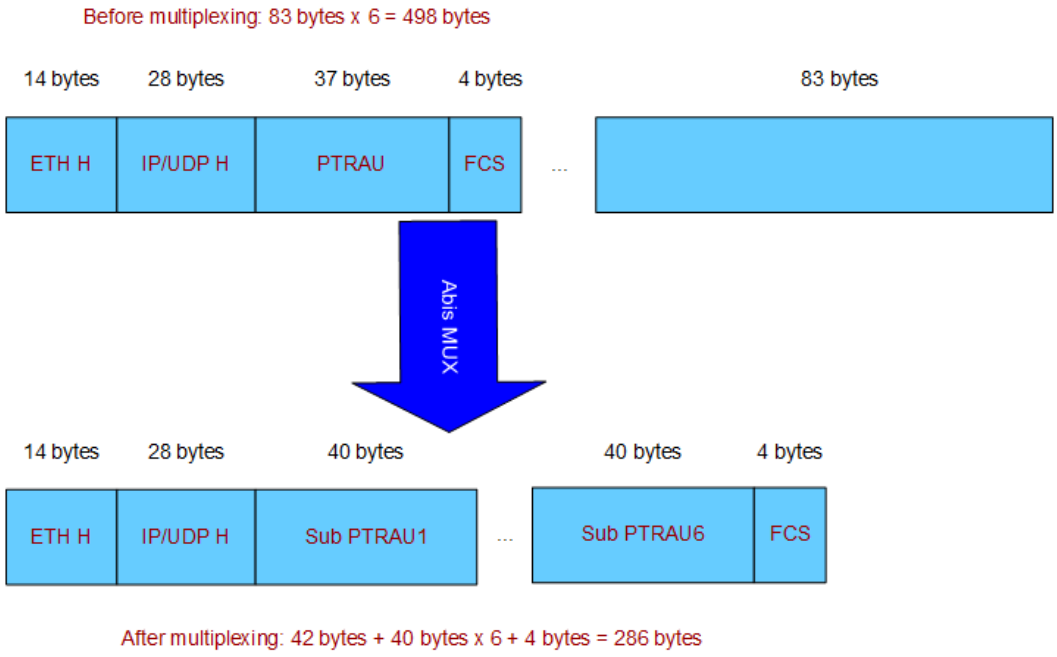
4.4.2 Network Analysis

4.4.2.1 Benefits

The transmission efficiency improved through Abis MUX is related to the length of original IP packets and the number of multiplexed frames. Shorter original IP packets and more multiplexed frames lead to higher transmission efficiency.

Figure 4-7 shows the frame format before and after Abis MUX is enabled.

Figure 4-7 Frame format before and after Abis MUX is enabled



Using EFR speech packets as an example, before Abis MUX is enabled, the sizes of the Ethernet header, IP/UDP header, and payload for a frame are 14, 28, and 37 bytes, respectively. Therefore, the total size of a frame is 83 bytes and the total size of six frames is 498 bytes. After Abis MUX is enabled, six frames are multiplexed. The total size of these multiplexed frames is 286 bytes, and the average size of each frame is 47.67 bytes.

Therefore, Abis MUX reduces the size of a frame by: (83-47.67)/83 = 42.56%

4.4.2.2 Impacts

Network Impacts

Abis MUX has no impact on system capacity and improves transmission efficiency on the Abis interface.

When transmission quality deteriorates, especially when bit errors occur, enabling Abis MUX has a negative impact on speech quality, for example, the mean opinion score (MOS) decreases. The impact can be minimized by reducing the value of the parameter related to multiplexing duration or by reducing the size of the frames to be multiplexed. However, the impact cannot be eliminated.

Function Impacts

RAT	Function Name	Function Switch	Reference	Description
GSM	IP QOS	None	*Transmission Resource Management*	When this feature is used with the Transmission Load Adjustment Based on Actual Traffic Measurement function of GBFD-118605 IP QOS, the Abis transmission efficiency increases significantly.

4.4.3 Requirements

4.4.3.1 Licenses

None

4.4.3.2 Software

Prerequisite Functions

RAT	Function Name	Function Switch	Reference	Description
GSM	Abis over IP	None	*IPv4 Transmission*	-
GSM	Abis IP over E1/T1	None	*IPv4 Transmission*	-

Mutually Exclusive Functions

None

4.4.3.3 Hardware

Base Station Models

3900 and 5900 series base stations

Boards

- BSC
  - If both the BSC and BTS use IP over E1/T1 transmission:

    The BSC6900 must be configured with the PEUa/PEUc/POUc board.

    The BSC6910 must be configured with the POUc board.
  - If the BTS uses IP over E1/T1 transmission, the BSC uses IP over Ethernet transmission, and the BSC and BTS are connected using a router:

    The BSC6900 must be configured with the FG2a/FG2c/FG2d/FG2e/GOUa/GOUc/GOUd board.

    The BSC6910 must be configured with the FG2c/FG2d/FG2e/GOUc/GOUd/EXOUa/EXOUb board.
  - If both the BSC and BTS use IP over E1/T1 transmission:

    The BSC6900 must be configured with the FG2a/FG2c/FG2d/FG2e/GOUa/GOUc/GOUd board.

    The BSC6910 must be configured with the FG2c/FG2d//FG2e/GOUc/GOUd/EXOUa/EXOUb board.
- BTS

  The BTS3006C and BTS3002E do not support this feature.

RF Modules

N/A

4.4.3.4 Networking

The Abis interface uses IP transmission.

4.4.4 Operation and Maintenance

4.4.4.1 When to Use

In an IP-based RAN backhaul network, Abis MUX is recommended if transmission bandwidth resources are insufficient but transmission quality is favorable.

Abis MUX is not recommended if the BER is higher than 10^{-6} or the transmission delay is close to the threshold that the Abis interface requires for the transmission network QoS.

4.4.4.2 Data Configuration

4.4.4.2.1 Data Preparation

The following table describes the key parameters that must be set in a **BTSGTRANSPARA** MO to enable IP MUX demultiplexing, and in a **BTSABISMUXFLOW** MO to configure Abis MUX on the GBTS side.

Table 4-6 Data to prepare before activating Abis MUX (GBTS)

Parameter Name	Parameter ID	Setting Notes
IPMUX Demultiplexing	**BTSGTRANSPARA.*IPMUXDEMULTIPLEX***	ENABLE(Enable)
Service Type	**BTSABISMUXFLOW.*SRVTYPE***	Network plan
Max Subframe Length	**BTSABISMUXFLOW.*SUBFRAMETHRES***	352
Maximum Frame Length	**BTSABISMUXFLOW.*PKTLENTHRES***	1031
Maximum Delay Time	**BTSABISMUXFLOW.*TIMEOUT***	2

NOTE

- If transmission quality is poor, for example, bit errors occur, decrease the values of ***TIMEOUT*** and ***PKTLENTHRES*** to improve service quality.
- If transmission quality is good but transmission bandwidth resources are insufficient, increase the values of ***TIMEOUT*** and ***PKTLENTHRES*** to save transmission bandwidth.

The following table describes the key parameters that must be set in a **TRANSFUNCTIONSW** MO to enable IP MUX demultiplexing, and in an **IPPATH** MO to configure Abis MUX on the eGBTS side.

Table 4-7 Data to prepare before activating Abis MUX (eGBTS)

Parameter Name	Parameter ID	Setting Notes
IP MUX Demultiplexing Switch	**TRANSFUNCTIONSW.*IPMUXDEMULTIPLEXSW***	ENABLE(Enable)
IP MUX Switch	**IPPATH.IPMUXSWITCH**	ENABLE(Enable)
Path Type	**IPPATH.PATHTYPE**	FIXED(Fixed QoS)

NOTE

- If transmission quality is poor, for example, bit errors occur, decrease the values of ***TIMER*** and ***FRAMELEN*** to improve service quality.
- If transmission quality is good but transmission bandwidth resources are insufficient, increase the values of ***TIMER*** and ***FRAMELEN*** to save transmission bandwidth.

The following table describes the key data that must be set in an **IPMUX** MO in non-transmission-resource-pool networking, and in an **IPPOOLMUX** MO in transmission resource pool networking, to configure Abis MUX for IP transmission on the BSC side.

Table 4-8 Data to prepare before activating Abis MUX in non-transmission-resource-pool networking (BSC)

Parameter Name	Parameter ID	Setting Notes
IP MUX Type	**IPMUX.*MUXTYPE***	FPMUX
Max subframe length[byte]	**IPMUX.*SUBFRAMELEN***	352
Maximum Frame Length[byte]	**IPMUX.*MAXFRAMELEN***	1031
Maximum Delay Time[ms]	**IPMUX.*FPTIMER***	2

Table 4-9 Data to prepare before activating Abis MUX in transmission resource pool networking (BSC)

Parameter Name	Parameter ID	Setting Notes
MUX Type	**IPPOOLMUX**.***MUXTYPE***	FPMUX

Parameter Name	Parameter ID	Setting Notes
Max subframe length[byte]	**IPPOOLMUX.*SUBFRAMELEN***	352
Maximum Frame Length[byte]	**IPPOOLMUX.*MAXFRAMELEN***	1031
Maximum Delay Time[ms]	**IPPOOLMUX.*FPTIMER***	2

NOTE

In non-transmission resource pool networking, the ***FPTIMER*** and ***MAXFRAMELEN*** parameters are used. In transmission resource pool networking, the ***FPTIMER*** and ***MAXFRAMELEN*** parameters are used.

- If transmission quality is poor, for example, bit errors occur, decrease parameter values to improve service quality.
- If transmission quality is good but transmission bandwidth resources are insufficient, increase parameter values to save transmission bandwidth.

The GBFD-118607 IP Performance Monitor feature can be activated to monitor IP transmission quality.

4.4.4.2.2 Using MML Commands

Activation Command Examples

When the old transmission configuration model is used (**GTRANSPARA.*TRANSCFGMODE*** is set to **OLD**):

```
//Activating Abis MUX
//Configuring the ANI, PATHID, and ISQOSPATH parameters based on the actual
situations on the BSC (no transmission resource pools are configured)
ADD IPMUX: MUXTYPE=ABISMUX, ANI=0, PATHID=0, ISQOSPATH=NO,IPMUXINDEX=0;
//Configuring the ANI, PHB, and IPPOOLMUXINDEX parameters based on the actual
situations on the BSC (transmission resource pools are configured)
ADD IPPOOLMUX: MUXTYPE=ABISMUX, ANI=0, PHB=BE,IPPOOLMUXINDEX=0;
//Activating IP MUX demultiplexing on the GBTS
SET BTSGTRANSPARA: IPMUXDEMULTIPLEX=ENABLE;
//Activating IP MUX demultiplexing on the eGBTS
SET TRANSFUNCTIONSW: IPMUXDEMULTIPLEXSW=ENABLE;
//GBTS
ADD BTSABISMUXFLOW: IDTYPE=BYID, BTSID=0, SRVTYPE=CSVOICE;
//eGBTS (initial configuration)
ADD IPPATH: PATHID=0, SN=6, SBT=BASE_BOARD, PT=PPP, JNRSCGRP=DISABLE,
LOCALIP="192.168.11.110", PEERIP="192.168.22.220", PATHTYPE=FIXED, DSCP=20,
IPMUXSWITCH=ENABLE, SUBFRAMELEN=127, FRAMELEN=270, TIMER=1;
//eGBTS (reconfiguration)
MOD IPPATH: PATHID=0, CN=0, SRN=0, SN=6, SBT=BASE_BOARD, PT=PPP, PN=0,
IPMUXSWITCH=ENABLE;
```

When the new transmission configuration model is used (**GTRANSPARA.*TRANSCFGMODE*** is set to **NEW**):

```
//Activating Abis MUX
//Configuring the ANI, PATHID, and ISQOSPATH parameters based on the actual
```

```
situations on the BSC (no transmission resource pools are configured)
ADD IPMUX: MUXTYPE=ABISMUX, ANI=0, PATHID=0, ISQOSPATH=NO,IPMUXINDEX=0;
//Configuring the ANI, PHB, and IPPOOLMUXINDEX parameters based on the actual
situations on the BSC (transmission resource pools are configured)
ADD IPPOOLMUX: MUXTYPE=ABISMUX, ANI=0, PHB=BE,IPPOOLMUXINDEX=0;
//Activating IP MUX demultiplexing on the GBTS
SET BTSGTRANSPARA: IPMUXDEMULTIPLEX=ENABLE;
//Activating IP MUX demultiplexing on the eGBTS
SET TRANSFUNCTIONSW: IPMUXDEMULTIPLEXSW=ENABLE;
//GBTS
ADD BTSABISMUXFLOW: IDTYPE=BYID, BTSID=0, SRVTYPE=CSVOICE;
//eGBTS (initial configuration)
ADD IPPATH: PATHID=0, TRANSCFGMODE=NEW, JNIPRSCGRP= DISABLE, BPT= PPP, PORTID=0,
LOCALIP="192.168.11.110", PEERIP="192.168.22.220", PATHTYPE=FIXED,
DSCP=20,IPMUXSWITCH=ENABLE,SUBFRAMELEN=127,FRAMELEN=270,TIMER=1;
//eGBTS (reconfiguration)
MOD IPPATH: PATHID=0, TRANSCFGMODE=NEW, BPT= PPP, PORTID=0, IPMUXSWITCH=ENABLE;
```

NOTE

The BSC can automatically assign a value to **IP MUX Index**. You can also set this parameter based on actual situations.

If **IS QOSPATH** is set to **YES(Yes)**, set the **PHB** parameter to specify the PHB type for which Abis MUX is to be activated.

Deactivation Command Examples

When the old transmission configuration model is used (**GTRANSPARA.*TRANSCFGMODE*** is set to **OLD**):

```
//Deactivating Abis MUX
//BSC (no transmission resource pools are configured)
RMV IPMUX: IPMUXINDEX=0;
//BSC (transmission resource pools are configured)
RMV IPPOOLMUX: IPPOOLMUXINDEX=0;
//GBTS
RMV BTSABISMUXFLOW: IDTYPE=BYID, BTSID=0, SRVTYPE=CSVOICE;
//eGBTS
MOD IPPATH: PATHID=0, CN=0, SRN=0, SN=6, SBT=BASE_BOARD, PT=PPP, PN=0,
IPMUXSWITCH=DISABLE;
```

When the new transmission configuration model is used (**GTRANSPARA.*TRANSCFGMODE*** is set to **NEW**):

```
//Deactivating Abis MUX
//BSC (no transmission resource pools are configured)
RMV IPMUX: IPMUXINDEX=0;
//BSC (transmission resource pools are configured)
RMV IPPOOLMUX: IPPOOLMUXINDEX=0;
//GBTS
RMV BTSABISMUXFLOW: IDTYPE=BYID, BTSID=0, SRVTYPE=CSVOICE;
//eGBTS
MOD IPPATH: PATHID=0, TRANSCFGMODE=NEW,BPT= PPP,PORTID=0,IPMUXSWITCH=DISABLE;
```

4.4.4.2.3 Using the CME

For detailed operations, see CME-based Feature Configuration.

4.4.4.3 Activation Verification

- BSC and GBTS
  - In non-transmission-resource-pool networking, run the BSC MML command **DSP IPMUX** to check the multiplexing information about Abis MUX.

    Expected result: The value of **IPMUX Status** is **Enable**.

- In transmission resource pool networking, run the BSC MML command **DSP IPPOOLMUX** to check the multiplexing information about Abis MUX.

  Expected result: The value of **IPMUX Status** is **Enable**.

- eGBTS

  Run the BTS MML command **DSP IPPATH** to query the information about Abis MUX.

  Expected result: The value of **IP MUX Switch** is **Enable**.

4.4.4.4 Network Monitoring

None

4.5 PPP MUX

4.5.1 Principles

PP MUX is a technology through which multiple PPP payloads (also called PPP MUX subframes) are encapsulated into a single PPP frame (also called a PPP MUX frame) to reduce the overhead of each PPP subframe and improve the bandwidth usage on PPP links.

PPP MUX applies to scenarios where short packets such as speech and data are transmitted over low-rate links. For long packets, PPP MUX does not improve the transmission efficiency adequately and prolongs the transmission delay. Therefore, using PPP MUX to transmit long packets is not recommended. PPP MUX is supported by:

- GSM: Ater interface of the BSC6900
- UMTS: Iub, Iur, and Iu interfaces of the base station controller and Iub interface of the NodeB
- LTE: S1 and X2 interfaces of the eNodeB

  NOTE

  NB-IoT does not support the X2 interface, and therefore PPP MUX is supported only over the S1 interface.

PPP MUX Frame Format

The PPP MUX frame format is defined in RFC3153.

By using PPP MUX, multiple PPP-encapsulated packets (or subframes) can be sent in a single PPP multiframe, reducing the PPP overhead of each frame. The PPP MUX frame is a multiframe, in which each multiplexed frame is called a subframe. Subframes in a PPP multiframe are separated by field separators, which ensures the recovery of PPP frames at the receive end.

Figure 4-8 shows the structure of a PPP MUX multiframe. **Figure 4-9** shows the structure of a subframe.

Figure 4-8 Structure of a PPP MUX frame

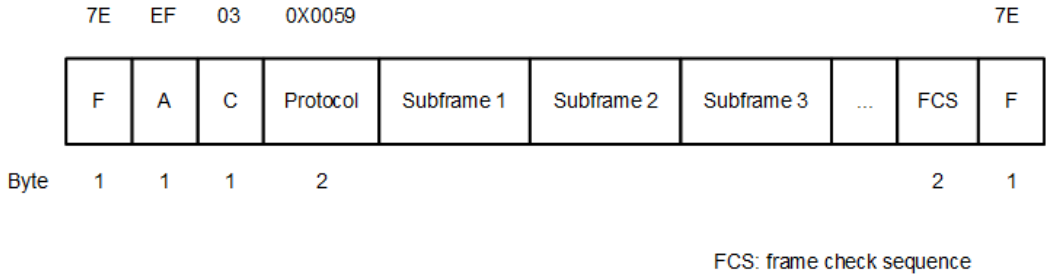
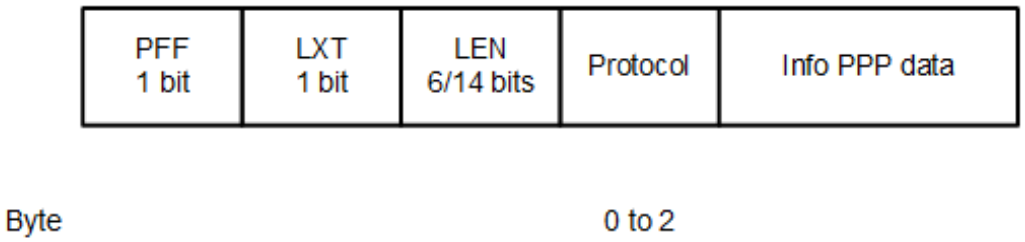


Figure 4-9 Structure of a PPP subframe



Each PPP MUX PDU consists of a 2-byte PPP MUX identifier (0X0059) and multiple subframes. Each subframe consists of the following:

- The protocol field flag (PFF) indicates whether a PPP identifier is included in the subframe.
- The length extension (LXT) bit indicates whether one or two bytes are contained in the length field.
- The subframe length (LEN) indicates the number of bytes occupied by the PPP identifier and information field of the subframe.

Compared with the original payload, each subframe is added with a 1-byte field indicating the length and a protocol identifier (PID) field that exists only in the header subframe. The PID field is shown in **Figure 4-9**. The PID field consists of zero to two bytes, indicating the multiplexed protocol types.

Parameters related to PPP MUX are as follows:

- PPP MUX switch: specifies whether to enable PPP MUX.
- Maximum PPP MUX subframe size: specifies the maximum size of a PPP MUX subframe. If the size of a PPP MUX subframe exceeds the value of this parameter, the subframe is transmitted directly without being multiplexed.
- Maximum PPP MUX frame size: specifies the maximum size of a PPP MUX frame.
- PPP MUX frame timer: specifies the maximum waiting time for multiplexing. If the waiting time exceeds the value of this parameter, the PPP MUX frame is transmitted without adding more PPP MUX subframes.

NE	PPP MUX Switch	Maximum PPP MUX Subframe Size	Maximum PPP MUX Frame Size	PPP MUX Frame Timer
BSC6900	PPPMUX	MAXSFLEN	MAXMFLEN	MUXTIME
BSC6910	PPPMUX	MAXSFLEN	MAXMFLEN	MUXTIME
NodeB	MUXCP	MAXSFLEN	MAXMFLEN	MUXTIME
eNodeB	MUXCP	MAXSFLEN	MAXMFLEN	MUXTIME

4.5.2 Network Analysis

4.5.2.1 Benefits

Multiplexing at the PPP/MLPPP layer can increase transmission capacity.

4.5.2.2 Impacts

Network Impacts

None

Function Impacts

None

4.5.3 Requirements

4.5.3.1 Licenses

None

4.5.3.2 Software

Prerequisite Functions

None

Mutually Exclusive Functions

None

4.5.3.3 Hardware

Base Station Models

The following base stations are compatible with this function:

- 3900 and 5900 series base stations
- DBS3900 LampSite and DBS5900 LampSite

Boards

- LTE

  The eNodeB must be configured with the UMPT board.
- GSM
  - To support PPP MUX for a PPP link, the BSC6900 must be configured with the POUa/UOIa/POUc board.
  - To support PPP MUX for an MLPPP group, the BSC6900 must be configured with the POUa/POUc board.
- UMTS
  - To support PPP MUX for a PPP link, the BSC6900 must be configured with the POUa/UOIa/POUc board, and the BSC6910 must be configured with the POUc board.
  - To support PPP MUX for an MLPPP group, the BSC6900 must be configured with the POUa/POUc board, and the BSC6910 must be configured with the POUc board.
  - The NodeB must be configured with the UMPT/WMPT board or the UMPT/WMPT+UTRP board combination.

RF Modules

None

4.5.3.4 Networking

IP over E1/T1 is applied when devices at the two ends use PPP MUX.

4.5.3.5 Others

- Base stations

  The equipment connected to the eNodeB/NodeB supports IP over E1/T1 and PPP MUX.
- Base station controllers

  The equipment connected to the BSC/RNC supports IP over E1/T1 and PPP MUX.

4.5.4 Operation and Maintenance

4.5.4.1 Data Configuration

4.5.4.1.1 Data Preparation

On the Base Station Side

- PPP MUX for a PPP link

  The following table describes the key parameters that must be set in a **PPPLNK** MO to configure PPP MUX for a PPP link. The cabinet number, subrack number, and slot number of the PPP link must be the same as those of the board where the link is located. If a UMPT board provides the transmission port, set the subboard type of the PPP link to **BASE_BOARD(Base Board)**.

Parameter Name	Parameter ID	Setting Notes
PPPMUX	**PPPLNK.*MUXCP***	Set this parameter to be consistent with the setting at the peer end.
Maximum Length of PPP Mux Subframe	**PPPLNK.*MAXSFLEN***	These parameters are valid only when the **PPPLNK.*MUXCP*** parameter is set to **ENABLE**. Set these parameters based on the network plan.
Maximum Length of PPP Muxframe	**PPPLNK.*MAXMFLEN***	
PPP Muxframe Combination Timeout	**PPPLNK.*MUXTIME***	
IP Header Compression	**PPPLNK.*IPHC***	Set this parameter based on the network plan.
Protocol Field Compression	**PPPLNK.*PFC***	Set this parameter based on the network plan.
Address and Control Field Compression	**PPPLNK.*ACFC***	Set this parameter based on the network plan.

- PPP MUX for an MLPPP group

  The following table describes the key parameters that must be set in an **MPGRP** MO to configure PPP MUX for an MLPPP group. The cabinet number, subrack number, and slot number of the MLPPP group must be the same as those of the board where the group is located. If a UMPT board provides the transmission port, set the subboard type of the MLPPP group to **BASE_BOARD(Base Board)**.

Parameter Name	Parameter ID	Setting Notes
PPPMUX	**MPGRP.*MUXCP***	Set this parameter to be consistent with the setting at the peer end.

Parameter Name	Parameter ID	Setting Notes
Maximum Length of PPP Mux Subframe	**MPGRP.*MAXSFLEN***	These parameters are valid only when the **MPGRP.*MUXCP*** parameter is set to **ENABLE**. Set these parameters based on the network plan.
Maximum Length of PPP Muxframe	**MPGRP.*MAXMFLEN***	
PPP Muxframe Combination Timeout	**MPGRP.*MUXTIME***	
IP Header Compression	**MPGRP.*IPHC***	Set this parameter based on the network plan.
Multi-Class PPP	**MPGRP.*MCPPP***	Set this parameter based on the network plan.
MP/MC Header Option	**MPGRP.*MHO***	These parameters are valid only when the **MPGRP.*MCPPP*** parameter is set to **ENABLE**. Set this parameter based on the network plan.
MCPPP Class	**MPGRP.*MCCLASS***	

The following table describes the key parameters that must be set in an **MPLNK** MO to configure PPP MUX for an MLPPP link in an MLPPP group. Before adding an MLPPP link to a specific MLPPP group, ensure that the MLPPP group has been configured. The cabinet number, subrack number, and slot number of an E1/T1 port must be the same as those of the board where the port is located. If a UMPT board provides the transmission port, set the subboard types of the MLPPP link, MLPPP group, and E1/T1 port to **BASE_BOARD(Base Board)**.

Parameter Name	Parameter ID	Setting Notes
Link No.	**MPLNK.*PPPLNKN***	Each MLPPP link in an MLPPP group must have a unique link number.
MLPPP Group No.	**MPLNK.*MPGRPN***	Each MLPPP group must have a unique group number.
Timeslot No.	**MPLNK.*TSN***	Set this parameter based on the network plan.
Maximum Receive Unit	**MPLNK.*MRU***	Set this parameter based on the network plan.
Protocol Field Compression	**MPLNK.*PFC***	Set this parameter to be consistent with the setting at the peer end.

Parameter Name	Parameter ID	Setting Notes
Address and Control Field Compression	**MPLNK.*ACFC***	Set this parameter to be consistent with the setting at the peer end.
Negotiation Time	**MPLNK.*RESTARTTMR***	The default value is recommended.

On the Base Station Controller Side

- PPP MUX for a PPP link

  The following table describes the key parameters that must be set in a **PPPLNK** MO to configure PPP MUX for a PPP link. The cabinet number, subrack number, and slot number of the PPP link must be the same as those of the board where the link is located.

Parameter Name	Parameter ID	Setting Notes
PPP mux	**PPPLNK.*PPPMUX***	Set this parameter to be consistent with the setting at the peer end.
PPP mux max sub-frame length	**PPPLNK.*MAXSFLEN***	These parameters are valid only when the ***PPPMUX*** parameter is set to **ENABLE**. Set these parameters based on the network plan.
PPP mux max mux-frame length	**PPPLNK.*MAXMFLEN***	
PPP mux framing out-time[us]	**PPPLNK.*MUXTIME***	
IP Header Compression	**PPPLNK.*IPHC***	Set this parameter based on the network plan.
Protocol field compress	**PPPLNK.*PFC***	Set this parameter based on the network plan.
Address and Control Field Compress	**PPPLNK.*ACFC***	Set this parameter based on the network plan.

- PPP MUX for an MLPPP group

  The following table describes the key parameters that must be set in an **MPGRP** MO to configure PPP MUX for an MLPPP group. The subrack number and slot number of the MLPPP group must be the same as those of the board where the group is located.

Parameter Name	Parameter ID	Setting Notes
MP type	**MPGRP.*MPTYPE***	Set this parameter based on the network plan.
MP/MC list head option	**MPGRP.*MHF***	Set this parameter based on the network plan.
MC PRI number	**MPGRP.*MCCLASS***	These parameters are valid only when the ***MPTYPE*** parameter is set to **MCPPP** Set these parameters based on the network plan.
PPP mux	**MPGRP.*PPPMUX***	Set this parameter to **ENABLE**. Set this parameter to be consistent with the setting at the peer end.
PPP mux max sub-frame length	**MPGRP.*MAXSFLEN***	These parameters are valid only when the ***PPPMUX*** parameter is set to **ENABLE**. Set these parameters based on the network plan.
PPP mux max mux-frame length	**MPGRP.*MAXMFLEN***	
PPP mux framing out-time[us]	**MPGRP.*MUXTIME***	
Head compress	**MPGRP.*IPHC***	Set this parameter based on the network plan.
Protocol field compress	**MPGRP.*PFC***	Set this parameter based on the network plan.
Address and Control Field Compress	**MPGRP.*ACFC***	Set this parameter based on the network plan.

The following table describes the key parameters that must be set in an **MPLNK** MO to configure PPP MUX for an MLPPP link in an MLPPP group. Before adding an MLPPP link to a specific MLPPP group, ensure that the MLPPP group has been configured. The subrack number and slot number of an E1/T1 port must be the same as those of the board where the port is located.

Parameter Name	Parameter ID	Setting Notes
MP Group No.	**MPLNK.*MPGRPN***	Each MLPPP group must have a unique group number.

Parameter Name	Parameter ID	Setting Notes
PPP sub-link No.	**MPLNK.*PPPLNKN***	Each MLPPP link in an MLPPP group must have a unique link number.
Bearing time slot	**MPLNK.*TSBITMAP***	Set this parameter based on the network plan.
Sub-protocol negotiate out time[S]	**MPLNK.*RESTARTTMR***	The default value is recommended.
Keep-alive timer length[S]	**MPLNK.*KEEPALIVE***	The default value is recommended.
CRC check mode	**MPLNK.*FCSTYPE***	The default value is recommended.

4.5.4.1.2 Using MML Commands

Activation Command Examples

- Base stations

  When the old transmission configuration model is used

  - PPP MUX for a PPP link

    ```
    ADD PPPLNK: CN=0, SRN=0, SN=6, SBT=BASE_BOARD, PPPLNKN=0, PN=0,
    AUTH=NONAUTH,
    TSN=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&T
    S12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22
    -1&TS23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1,
    LOCALIP="192.168.20.3", IPMASK="255.255.255.0", PEERIP="192.168.20.75",
    MUXCP=ENABLE;
    ```

  - PPP MUX for an MLPPP group

    ```
    ADD MPGRP: CN=0, SRN=0, SN=7, SBT=BASE_BOARD, MPGRPN=0, AUTH=NONAUTH,
    LOCALIP="192.168.20.3", IPMASK="255.255.255.0", PEERIP="192.168.20.75",
    MUXCP=ENABLE, IPHC=ENABLE, MCPPP=ENABLE, MHO=LONG;
    ADD MPLNK: CN=0, SRN=0, SN=7, SBT=BASE_BOARD, PPPLNKN=0, MPGRPN=0,
    MPGRPSBT=BASE_BOARD, E1T1SRN=0, E1T1SN=7, E1T1SBT=BASE_BOARD, E1T1PN=0,
    TSN=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&T
    S12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22
    -1&TS23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1;
    ```

  When the new transmission configuration model is used

  - PPP MUX for a PPP link

    ```
    ADD PPPLNK: CN=0, SRN=0, SN=6, SBT=BASE_BOARD, PPPLNKN=0, PN=0,
    AUTH=NONAUTH,
    TSN=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&T
    S12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22
    -1&TS23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1,
    LOCALIP="192.168.20.3", IPMASK="255.255.255.0", PEERIP="192.168.20.75",
    MUXCP=ENABLE;
    ```

  - PPP MUX for an MLPPP group

    ```
    ADD MPGRP: CN=0, SRN=0, SN=7, SBT=BASE_BOARD, MPGRPN=0, AUTH=NONAUTH,
    LOCALIP="192.168.20.3", IPMASK="255.255.255.0", PEERIP="192.168.20.75",
    MUXCP=ENABLE, IPHC=ENABLE, MCPPP=ENABLE, MHO=LONG;
    ADD MPLNK: CN=0, SRN=0, SN=7, SBT=BASE_BOARD, PPPLNKN=0, MPGRPN=0,
    ```



```
MPGRPSBT=BASE_BOARD, E1T1SRN=0, E1T1SN=7, E1T1SBT=BASE_BOARD, E1T1PN=0,
TSN=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&T
S12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22
-1&TS23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1;
```

- Base station controllers
  - PPP MUX for a PPP link

    ```
    ADD PPPLNK: SRN=0, SN=21, BRDTYPE=POUc, PPPLNKN=0, DS1=0,
    TSBITMAP=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS1
    1-1&TS12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1
    &TS22-1&TS23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1,
    BORROWDEVIP=NO, LOCALIP="192.168.20.75", MASK="255.255.255.0",
    PEERIP="192.168.20.3", PPPMUX=Enable, AUTHTYPE=NO_V,
    FLOWCTRLSWITCH=ON,OPSEPFLAG=OFF;
    ```

  - PPP MUX for an MLPPP group

    ```
    ADD MPGRP: SRN=0, SN=21, BRDTYPE=POUc, MPGRPN=0, MPTYPE=MCPPP,
    BORROWDEVIP=NO, LOCALIP="192.168.20.75", MASK="255.255.255.0",
    PEERIP="192.168.20.3", MHF=LONG, PPPMUX=Enable, FLOWCTRLSWITCH=ON,
    AUTHTYPE=NO_V, ERRDETECTSW=OFF, ANTIERRFLAG=OFF, OPSEPFLAG=OFF;
    ADD MPLNK: SRN=0, SN=21, BRDTYPE=POUc, MPGRPN=0, PPPLNKN=0, DS1=0,
    TSBITMAP=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS1
    1-1&TS12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1
    &TS22-1&TS23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1;
    ```

4.5.4.1.3 Using the CME

For detailed operations, see CME-based Feature Configuration.

4.5.4.2 Activation Verification

- PPP MUX for a PPP link

  Run the **DSP PPPLNK** command, and then check the command output. If the value of **Link Status** is **Up**, PPP MUX for the PPP link has been activated.

- PPP MUX for an MLPPP group

  Run the **DSP MPGRP** command, and then check the command output. If the value of **MLPPP Group Status** is **Up**, PPP MUX for the MLPPP group has been activated.

4.5.4.3 Network Monitoring

None

5 Header Compression

5.1 Overview

Header compression is used in IP over E1/T1 transmission to reduce the frame header load on PPP links or MLPPP links so that transmission bandwidth usage increases. Header compression requires point-to-point support from both the transmit and receive ends.

Header compression technologies include:

- IP Header Compression (IPHC)
- PPP Header Compression (PPPHC): Address and Control Field Compression (ACFC) and Protocol Field Compression (PFC)

Compared with multiplexing, header compression is more suitable when the BER is high.

5.2 IPHC

5.2.1 Principles

As defined in RFC2507 and RFC3544, IPHC is a standard compression technology in IP over E1 transmission and is used to compress the IP, UDP, and RTP headers transmitted over PPP links. IPHC deletes redundant information from the headers of IP or UDP packets that share the same source and destination IP addresses as well as the same source and destination ports in the UDP data flow. This improves transmission efficiency and saves IP transmission resources.

The IPHC working principles are as follows:

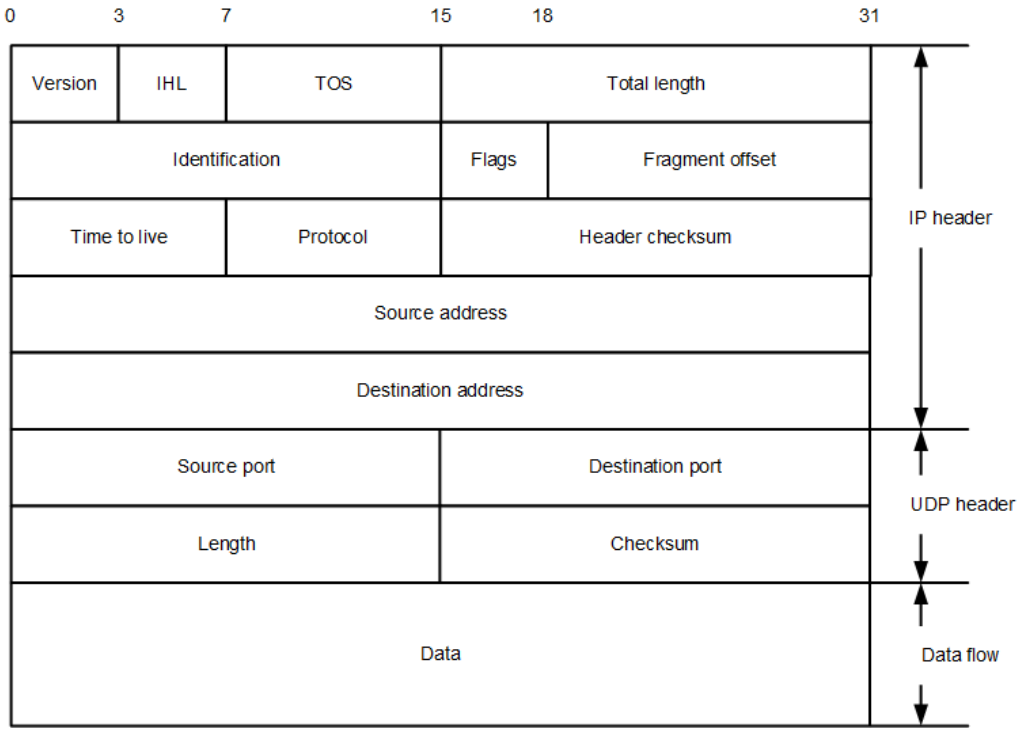
- Fixed fields in the IP, UDP, and RTP headers are only included in some packets, and variable fields are represented in fewer bits.
- During PPP link establishment, packets with complete headers are transmitted to establish the header context at both ends. Subsequently, complete headers are retrieved from the compressed header based on the header context and the variable fields.

The IPHC-related parameters specify whether header compression is supported by both ends of a PPP or MLPPP link. That is, the two ends negotiate whether to compress the UDP, IP, and RTP headers during link establishment.

IPHC removes redundant information in UDP/IP headers in UDP data flows to improve transmission efficiency.

The user plane uses UDP/IP protocols. A typical data packet includes an 8-byte UDP header and a 20-byte IP header. **Figure 5-1** shows the frame structure of a UDP/IP packet. The UDP header contains 4 fields, indicating the IP addresses of the source and destination UDP ports, packet length, and packet checksum. The IP header contains 12 fields, indicating the source and destination IP addresses and type of service (ToS).

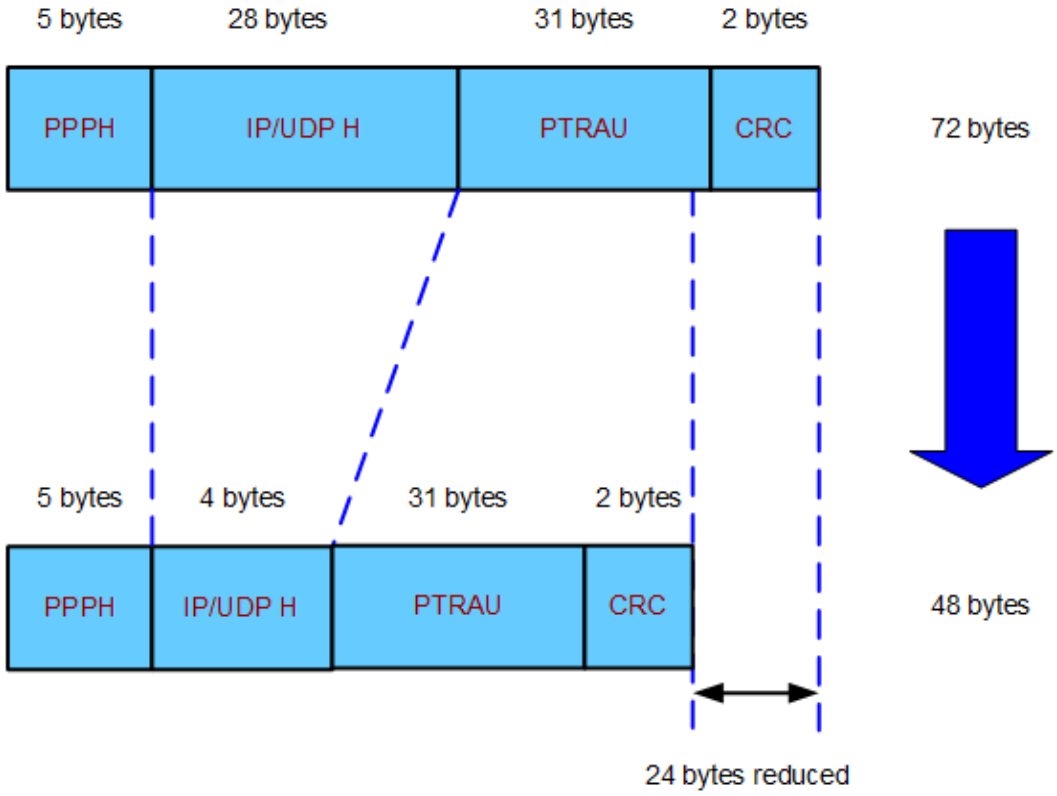
Figure 5-1 Frame structure of a UDP/IP packet



All packets in the same data flow have the same source and destination IP addresses. Most fields in each packet header have constant values during transmission. IPHC compresses these constant fields. In this way, the transmit end can use a simplified header to replace a standard header (the IP/UDP header shown in **Figure 5-1**, which has 16 fields and occupies 28 bytes). Therefore, the header size is reduced by 80%.

A UDP/IP header for GSM and UMTS is reduced from 28 bytes to 4 bytes, as shown in **Figure 5-2**.

Figure 5-2 IPHC working principle



A UDP/IP header for LTE is reduced from 28 bytes to 5 bytes. The 5-byte compressed header contains a context identifier (CID, 2 bytes), a generation field (1 byte), and an IP identifier (2 bytes). The header is enough for uniquely identifying the data flow. The receive end replaces the compressed header with the standard header before decompressing the header.

5.2.2 Network Analysis

5.2.2.1 Benefits

IPHC is recommended if IP headers are required to be compressed to reduce transmission overhead.

IPHC increases bandwidth usage, depending on the payload size. A smaller payload value will result in higher bandwidth usage.

- Without Abis MUX, IPHC improves transmission efficiency on the Abis interface by about 33%.

  Using FR speech packets as an example, before Abis IPHC is enabled, the sizes of the IP/UDP header and payload are 28 and 37 bytes, respectively. The size of a packet is 72 bytes. After Abis IPHC is enabled, the size of the IP/UDP header is reduced to 4 bytes and therefore the size of an IP/UDP packet is reduced to 48 bytes.

  Abis IPHC reduces the size of a packet by: (72 – 48)/72 = 33%
- With Abis MUX, IPHC further improves transmission efficiency on the Abis interface by about 5%.

For example, the size of a packet is 447 bytes after 10 speech packets are multiplexed using Abis MUX. After IPHC, the size of the packet is further reduced to 423 bytes.

Abis IPHC reduces the size of a packet by: (447 – 423)/447 = 5.4%

5.2.2.2 Impacts

Network Impacts

None

Function Impacts

None

5.2.3 Requirements

5.2.3.1 Licenses

Feature ID	Feature Name	Model	License Control Item Name	NE	Sales Unit
GBFD-118612	Abis IPHC	LGMIABIPHC	Abis IPHC	BSC6900 BSC6910	per TRX

5.2.3.2 Software

Prerequisite Functions

LBFD-00300401 IP Header Compression, MLBFD-12000304 Compression & Multiplexing over E1/T1, and TDLBFD-00300401 IP Header Compression do not have prerequisite functions.

GBFD-118612 Abis IPHC has the following prerequisite function.

RAT	Function Name	Function Switch	Reference	Description
GSM	Abis IP over E1/T1	None	*IPv4 Transmission*	-

Mutually Exclusive Functions

None

5.2.3.3 Hardware

Base Station Models

- For FDD/TDD/NB-IoT, the following base stations are compatible with this function:
  - 3900 and 5900 series base stations
  - DBS3900 LampSite and DBS5900 LampSite
- For GSM, the following base stations are compatible with this function:

  3900 and 5900 series base stations

Boards

- LTE

The eNodeB must be configured with the UMPT board. The LMPT board does not support IPHC.

- GSM

  BSC:
  - If both the BSC and BTS use IP over E1/T1 transmission, the BSC6900/BSC6910 must be configured with the POUc board.

    NOTE

    The PEU board on the BSC does not support the Abis IPHC feature.
  - If the BTS uses IP over E1/T1 transmission, the BSC uses IP over Ethernet transmission, and the BSC and BTS are connected using a router, then the BSC6900 must be configured with the FG2a/FG2c/FG2d/FG2e/GOUa/GOUc/GOUd board and the BSC6910 must be configured with the FG2c/FG2d/FG2e/GOUc/GOUd/EXOUa/EXOUb board.

  BTS:
  - For the GBTS, the GTMUb/GTMUc board must be configured on 3900 series base stations except the BTS3900B and BTS3900E.
  - The DPTU board must be configured on the BTS3012 and BTS3012AE.
  - The eGBTS must be configured with the UTRP/UMPT/GTMUb/GTMUc board.

The router must support IPHC.

- UMTS
  - RNC:

    To support IPHC for a PPP link, the BSC6900 must be configured with the PEUa/PEUc/POUa/UOIa/POUc board.

    To support IPHC for an MLPPP group, the BSC6900 must be configured with the PEUa/PEUc/POUa/POUc board.
  - NodeB:

    The BTS3900 or BTS5900 must be configured with the UTRP/UMPT/WMPT board.

RF Modules

None

5.2.3.4 Networking

Transmission bandwidth is properly planned.

IP over E1/T1 is applied to devices at the two ends where IPHC is used.

Abis IPHC applies to the following networking scenarios:

- E2E IP over E1 networking The BTS negotiates IPHC parameters with the BSC. IPHC is enabled on both the BTS and the BSC to perform bidirectional compression.

  Figure 5-3 E2E IP over E1 transmission

- IP over FE/GE transmission from the BSC to a router and IP over E1 transmission from the router to the BTS: The BTS negotiates IPHC parameters with the router. The router supports UDP packet header compression implemented by IPHC. This saves transmission resources between the BTS and the router.

  Figure 5-4 IP over FE/GE transmission from the BSC to a router and IP over E1 transmission from the router to the BTS

- BTS cascading in IP over E1 transmission Cascaded BTSs perform IPHC compression and decompression on local and passing-by packet flows.

  Figure 5-5 BTS cascading in IP over E1 transmission

UMTS has the same networking scenarios as GSM.

5.2.3.5 Others

- eNodeB/NodeB/eGBTS

  The peer equipment connected to the eNodeB/NodeB/eGBTS supports IP over E1/T1 and IPHC.

- GBTS

  The peer equipment connected to the GBTS supports IP over E1/T1 and IPHC.

- Base station controller

  The peer equipment connected to the RNC supports IP over E1/T1 and IPHC.

Collect the following information before deploying IPHC.

- If both the BSC and BTS use IP over E1/T1 transmission:

  Ensure that the BSC and BTS support Abis IPHC.

- If the BTS uses IP over E1/T1 transmission, the BSC uses IP over Ethernet transmission, and the BSC and BTS are connected using a router:

  Ensure that the router and BTS support Abis IPHC.

NOTE

The BTS allows compression of non-TCP packets (UDP packets). It does not allow compression of TCP and non-TCP packets simultaneously or compression of RTP packets. When the BTS is interconnected with a router, the router needs to allow compression of only non-TCP packets (UDP packets).

Collect information about the BTS traffic model and Abis link bandwidth to determine whether to enable this feature. This is because this feature is used only if bandwidth requirements still cannot be met after VAD or Abis MUX is used.

5.2.4 Operation and Maintenance

5.2.4.1 When to Use

It is recommended that this feature be enabled in the following scenarios:

- E1 resources are insufficient.

NOTE

Use following functions in a descending order of priority to save transmission resources: VAD, Abis MUX, Abis IPHC, and local switching. If bandwidth requirements still cannot be met after VAD or Abis MUX is used, enable Abis IPHC. Use of the local switching function must be permitted by the operator because the function involves lawful interception.

- High-BER scenarios, such as microwave transmission in a desert. The instantaneous BER may be larger than 1e-6 due to large temperature differences during a day and a harsh environment. In these scenarios, it is recommended that IPHC be enabled to improve transmission efficiency instead of Abis MUX. This is because Abis MUX increases the packet size, and therefore increases the packet loss rate. As a result, speech quality deteriorates in high-BER scenarios. Unlike Abis MUX, IPHC reduces packet size, and therefore decreases the packet loss rate. As a result, speech quality is improved.
- When base stations are cascaded in IP over E1 transmission and the transmission bandwidth between base stations is insufficient, enable IPHC on the MP/PPP links between the base stations.

When TDM transmission is converted to IP over E1 transmission or IP over E1 transmission is newly deployed, the bandwidth is limited. In this case, it is recommended that IPHC be enabled to improve transmission efficiency. Abis MUX can be enabled together with IPHC and this further improves transmission efficiency by about 5%.

5.2.4.2 Data Configuration

5.2.4.2.1 Data Preparation

Data Preparation for eNodeB/NodeB/eGBTS

- IPHC for a PPP link

  The following table describes the key parameters that must be set in a **PPPLNK** MO to configure IPHC for a PPP link. The cabinet number, subrack number, and slot number of the PPP link must be the same as those of the board where the link is located. If a UMPT board provides the transmission port, set the subboard type of the PPP link to **BASE_BOARD(Base Board)**.

Parameter Name	Parameter ID	Setting Notes
Link No.	**PPPLNK.*PPPLNKN***	Each PPP link/MLPPP link must have a unique link number.
Port No.	**PPPLNK.*PN***	Set this parameter based on the actual connection and the peer network device configuration.
Authentication Type	**PPPLNK.*AUTH***	The setting of this parameter must be consistent with that in the peer network device.
User Name	**PPPLNK.*UN***	These parameters are valid only when the **PPPLNK.*AUTH*** parameter is not set to **NONAUTH(No Authentication)**. The settings of these parameters must be consistent with those in the peer network device.
Password	**PPPLNK.*PWD***	
Bearing time slot	**PPPLNK.*TSN***	The setting of this parameter must be consistent with that in the peer network device.
Local IP	**PPPLNK.*LOCALIP***	Set this parameter based on the network plan.
Mask	**PPPLNK.*IPMASK***	Set this parameter based on the network plan.
Peer IP	**PPPLNK.*PEERIP***	Set this parameter based on the network plan.
PPPMUX	**PPPLNK.*MUXCP***	The setting of this parameter must be consistent with that in the peer network device.
Head compress	**PPPLNK.*IPHC***	Set this parameter to **ENABLE** at local and peer ends.

Parameter Name	Parameter ID	Setting Notes
IPHC SubOption	**PPPLNK.*IPHCSUBOPT***	Set this parameter if the peer device needs to negotiate with the local device about the setting of this parameter.

- IPHC for an MLPPP group

  The following table describes the key parameters that must be set in an **MPGRP** MO to configure IPHC for an MLPPP group. The cabinet number, subrack number, and slot number of the MLPPP group must be the same as those of the board where the group is located. If a UMPT board provides the transmission port, set the subboard type of the MLPPP group to **BASE_BOARD(Base Board)**.

Parameter Name	Parameter ID	Setting Notes
Group No.	**MPGRP.*MPGRPN***	Each MLPPP group must have a unique group number.
Authentication Type	**MPGRP.*AUTH***	The setting of this parameter must be consistent with that in the peer network device.
User Name	**MPGRP.*UN***	These parameters are valid only when the **MPGRP.*AUTH*** parameter is not set to **NONAUTH(No Authentication)**. The settings of these parameter must be consistent with those in the peer network device.
Password	**MPGRP.*PWD***	
Local IP	**MPGRP.*LOCALIP***	Set this parameter based on the network plan.
Mask	**MPGRP.*IPMASK***	Set this parameter based on the network plan.
Peer IP	**MPGRP.*PEERIP***	Set this parameter based on the network plan.
MLPPP Fragment Size	**MPGRP.*FRAGSIZE***	Set this parameter based on the network plan.
PPPMUX	**MPGRP.*MUXCP***	The setting of this parameter must be consistent with that in the peer network device.
Head compress	**MPGRP.*IPHC***	The setting of this parameter must be consistent with that in the peer network device.

Parameter Name	Parameter ID	Setting Notes
IPHC SubOption	**MPGRP**.***IPHCSUBOPT***	Set this parameter if the peer device needs to negotiate with the local device about the setting of this parameter.
Multi-Class PPP	**MPGRP**.***MCPPP***	The setting of this parameter must be consistent with that in the peer network device.

The following table describes the key parameters that must be set in an **MPLNK** MO to configure IPHC for an MLPPP link in an MLPPP group. Before adding an MLPPP link to a specific MLPPP group, ensure that the MLPPP group has been configured. The cabinet number, subrack number, and slot number of an E1/T1 port must be the same as those of the board where the port is located. If a UMPT board provides the transmission port, set the subboard types of the MLPPP link, MLPPP group, and E1/T1 port to **BASE_BOARD(Base Board)**.

Parameter Name	Parameter ID	Setting Notes
Link No.	**MPLNK**.***PPPLNKN***	Each MLPPP link in an MLPPP group must have a unique link number.
MLPPP Group No.	**MPLNK**.***MPGRPN***	Each MLPPP group must have a unique group number.
Bearing time slot	**MPLNK**.***TSN***	Set this parameter based on the network plan.
Maximum Receive Unit	**MPLNK**.***MRU***	Set this parameter based on the network plan.
Protocol field compress	**MPLNK**.***PFC***	Set this parameter to **DISABLE**. Set this parameter to be consistent with the setting at the peer end.
Address and Control Field Compression	**MPLNK**.***ACFC***	Set this parameter to **DISABLE**. Set this parameter to be consistent with the setting at the peer end.
Negotiation Time	**MPLNK**.***RESTARTTMR***	The default value is recommended.

Data Preparation for GBTS

Table 5-1 Data to prepare before activating Abis IPHC on the GBTS side (related MO: **BTSPPPLNK** or **BTSMPGRP**)

Parameter Name	Parameter ID	Setting Notes
IP Header Compression	**BTSPPPLNK**.***IPHC***	Set this parameter to **ENABLE**.
IP Header Compression	**BTSMPGRP**.***IPHC***	Set this parameter to **ENABLE**.

Table 5-2 Data to prepare before activating Abis IPHC on the BSC side (related MO: **PPPLNK** or **MPGRP**)

Parameter Name	Parameter ID	Setting Notes
Head compress	**PPPLNK**.**IPHC**	Set this parameter to **UDP/IP_HC(UDP/IP_HC)**.
Head compress	**MPGRP**.**IPHC**	Set this parameter to **UDP/IP_HC(UDP/IP_HC)**.

Data Preparation for Base Station Controller

- IPHC for a PPP link

  The following table describes the key parameters that must be set in a **PPPLNK** MO to configure IPHC for a PPP link. The subrack number and slot number of the PPP link must be the same as those of the board where the link is located.

Parameter Name	Parameter ID	Setting Notes
Link No.	**PPPLNK**.***PPPLNKN***	Each PPP link/MLPPP link must have a unique link number.
E1T1 port No.	**PPPLNK**.***DS1***	Set this parameter based on the actual connection and the peer configuration.
Bearing time slot	**PPPLNK**.***TSBITMAP***	Set this parameter to be consistent with the setting at the peer end.
Borrow DevIP	**PPPLNK**.***BORROWDEVIP***	Set this parameter based on the network plan.

Parameter Name	Parameter ID	Setting Notes
Borrowed device IP address	**PPPLNK.*DEVIP***	This parameter is valid only if the **PPPLNK.*BORROWDEVIP*** parameter is not set to **YES**.
Local IP address	**PPPLNK.*LOCALIP***	Set this parameter based on the network plan.
Subnet mask	**PPPLNK.*MASK***	Set this parameter based on the network plan.
Peer IP address	**PPPLNK.*PEERIP***	Set this parameter based on the network plan.
Head compress	**PPPLNK.*IPHC***	Set this parameter to **UDP/IP_HC(UDP/IP_HC)** or **RTP/UDP/IP_HC(RTP/UDP/IP_HC)**. Set this parameter to be consistent with the setting at the peer end.
PPP mux	**PPPLNK.*PPPMUX***	Set this parameter to be consistent with the setting at the peer end.
Validate protocol type	**PPPLNK.*AUTHTYPE***	Set this parameter to be consistent with the setting at the peer end.
Validate user name	**PPPLNK.*AUTHNAME***	These parameters are valid only if the **PPPLNK.*AUTHTYPE*** parameter is not set to **NO_V(NO_V)**. Set this parameter to be consistent with the setting at the peer end.
Validate password	**PPPLNK.*AUTHPWD***	
Validate mode	**PPPLNK.*AUTHMODE***	

- IPHC for an MLPPP group

  The following table describes the key parameters that must be set in an **MPGRP** MO to configure IPHC for an MLPPP group. The subrack number and slot number of the MLPPP group must be the same as those of the board where the group is located.

Parameter Name	Parameter ID	Setting Notes
MP Group No.	**MPGRP.*MPGRPN***	Set this parameter based on the network plan.
MP type	**MPGRP.*MPTYPE***	Set this parameter to be consistent with the setting at the peer end.
Borrow DevIP	**MPGRP.*BORROWDEVIP***	Set this parameter based on the network plan.

Parameter Name	Parameter ID	Setting Notes
Borrowed device IP address	**MPGRP.*DEVIP***	This parameter is valid only if the **MPGRP.*BORROWDEVIP*** parameter is not set to **YES**.
Local IP address	**MPGRP.*LOCALIP***	Set this parameter based on the network plan.
Subnet mask	**MPGRP.*MASK***	Set this parameter based on the network plan.
MP/MC list head option	**MPGRP.*MHF***	Set this parameter based on the network plan.
MC PRI number	**MPGRP.*MCCLASS***	This parameter is valid only if the **MPGRP.*MPTYPE*** parameter is set to **MCPPP**.
Head compress	**MPGRP.*IPHC***	Set this parameter to **UDP/IP_HC(UDP/IP_HC)** or **RTP/UDP/IP_HC(RTP/UDP/IP_HC)**. Set this parameter to be consistent with the setting at the peer end.
Protocol field compress	**MPGRP.*PFC***	Set this parameter to be consistent with the setting at the peer end.
Address and Control Field Compress	**MPGRP.*ACFC***	Set this parameter based on the network plan. Set this parameter to be consistent with the setting at the peer end.
PPP mux	**MPGRP.*PPPMUX***	Set this parameter to be consistent with the setting at the peer end.
PPP mux max sub-frame length	**MPGRP.*MAXSFLEN***	These parameters are valid only if the **MPGRP.*PPPMUX*** parameter is set to **ENABLE**. Set this parameter based on the network plan.
PPP mux max mux-frame length	**MPGRP.*MAXMFLEN***	
PPP mux framing out-time[us]	**MPGRP.*MUXTIME***	

The following table describes the key parameters that must be set in an **MPLNK** MO to configure IPHC for an MLPPP link in an MLPPP group. Before adding an MLPPP link to a specific MLPPP group, ensure that the MLPPP group has been configured. The subrack number and slot number of an E1/T1 port must be the same as those of the board where the port is located.

Parameter Name	Parameter ID	Setting Notes
MP Group No.	**MPLNK.*MPGRPN***	Each PPP link/MLPPP link must have a unique link number.
PPP sub-link No.	**MPLNK.*PPPLNKN***	Each PPP or MLPPP link must have a unique link number.
E1T1 port No.	**MPLNK.*DS1***	Set this parameter based on the actual connection and the peer configuration.
Bearing time slot	**MPLNK.*TSBITMAP***	Set this parameter to be consistent with the setting at the peer end.
CRC check mode	**MPLNK.*FCSTYPE***	Set this parameter based on the network plan.

5.2.4.2.2 Using MML Commands

Activation Command Examples

- eNodeB/NodeB/eGBTS

  For newly deployed base stations

  - IPHC for a PPP link

    ```
    ADD PPPLNK: CN=0, SRN=0, SN=6, SBT=BASE_BOARD, PPPLNKN=0, PN=0,
    AUTH=NONAUTH,
    TSN=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&T
    S12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22
    -1&TS23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1,
    LOCALIP="192.168.20.3", IPMASK="255.255.255.0", MUXCP=DISABLE,
    IPHC=ENABLE;
    ```

  - IPHC for an MLPPP group

    ```
    ADD MPGRP: CN=0, SRN=0, SN=7, SBT=BASE_BOARD, MPGRPN=0, AUTH=NONAUTH,
    LOCALIP="10.10.10.10", IPMASK="255.255.255.0", MUXCP=DISABLE,
    IPHC=ENABLE, MCPPP=ENABLE, MHO=LONG;
    ADD MPLNK: CN=0, SRN=0, SN=7, SBT=BASE_BOARD, PPPLNKN=0, MPGRPN=0,
    E1T1SRN=0, E1T1SN=7, E1T1SBT=BASE_BOARD, E1T1PN=0,
    TSN=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&T
    S12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22
    -1&TS23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1;
    ```

  For existing base stations

  NOTICE

  Setting the ***IPHC*** parameter in this step will cause the base station to re-initiate a negotiation to establish a PPP link or an MLPPP group. The negotiation may cause mute voices or interrupt data transmission for less than 3s.

  - IPHC for a PPP link

    ```
    MOD PPPLNK: CN=0, SRN=0, SN=6, SBT=BASE_BOARD, PPPLNKN=0, PN=0,
    IPHC=ENABLE;
    ```

- IPHC for an MLPPP group

```
MOD MPGRP: CN=0, SRN=0, SN=7, SBT=BASE_BOARD, MPGRPN=0, IPHC=ENABLE;
```

- GBTS

  For newly deployed base stations

  - IPHC for a PPP link

```
ADD BTSPPPLNK: IDTYPE=BYID, BTSID=200, PPPLNKN=0, PN=0, CN=0, SRN=0,
SN=6,
TSBITMAP=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS1
1-1&TS12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1
&TS22-1&TS23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1,
LOCALIP="192.168.20.3", MASK="255.255.255.0", PEERIP="192.168.20.75",
AUTHTYPE=NO_V, IPHC=ENABLE;
```

  - IPHC for an MLPPP group

```
ADD BTSMPGRP: IDTYPE=BYID, BTSID=200, MPGRPN=0, CN=0, SRN=0, SN=6,
LOCALIP="192.168.20.3", MASK="255.255.255.0", PEERIP="192.168.20.75",
MPSWITCH=ENABLE, AUTHTYPE=NO_V, IPHC=ENABLE;
```

  For existing base stations

NOTICE

Setting the ***IPHC*** parameter in this step will cause the base station to re-initiate a negotiation to establish a PPP link or an MLPPP group. The negotiation may cause mute voices or interrupt data transmission for less than 3s.

  - IPHC for a PPP link

```
MOD BTSPPPLNK: IDTYPE=BYID, BTSID=200, PPPLNKN=0, IPHC=ENABLE;
```

  - IPHC for an MLPPP group

```
MOD BTSMPGRP: IDTYPE=BYID, BTSID=200, MPGRPN=0, IPHC=ENABLE;
```

- Base station controller

  For newly deployed base station controllers

  - IPHC for a PPP link

```
ADD PPPLNK: SRN=0, SN=26, BRDTYPE=POUc, PPPLNKN=0, DS1=0,
TSBITMAP=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS1
1-1&TS12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1
&TS22-1&TS23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1,
BORROWDEVIP=NO, LOCALIP="5.5.5.5", MASK="255.255.255.0",
PEERIP="5.5.5.6", IPHC=RTP/UDP/IP_HC, PPPMUX=Disable, AUTHTYPE=NO_V,
FLOWCTRLSWITCH=ON, OPSEPFLAG=OFF;
```

  - IPHC for an MLPPP group

```
ADD MPGRP: SRN=0, SN=26, BRDTYPE=POUc, MPGRPN=0, MPTYPE=MCPPP,
BORROWDEVIP=NO, LOCALIP="9.9.9.99", MASK="255.255.255.0",
PEERIP="9.9.9.98", MHF=LONG, IPHC=UDP/IP_HC, PPPMUX=Disable,
FLOWCTRLSWITCH=ON, AUTHTYPE=NO_V, ERRDETECTSW=OFF, ANTIERRFLAG=OFF,
OPSEPFLAG=OFF;
```

NOTE

If the BSC uses IP over FE/GE transmission:

- Enable the IPHC function for the routers and then for the BTSs.
- Do not enable the IPHC function for the BSC.
- Enable the routers to support the IPHC function only for UDP packet headers.

For existing Base station controllers

NOTICE

Setting the ***IPHC*** parameter in this step will cause the base station to re-initiate a negotiation to establish a PPP link or an MLPPP group. The negotiation may cause mute voices or interrupt data transmission for less than 3s.

- Configure IPHC for a PPP link. Set **Subrack No.** and **Slot No.** to the subrack number and slot number of the POUc board.
  ```
  MOD PPPLNK: SRN=0, SN=26, BRDTYPE=POUc, PPPLNKN=0, IPHC=UDP/IP_HC;
  ```
- Configure IPHC for an MLPPP group. Set **Subrack No.** and **Slot No.** to the subrack number and slot number of the POUc board.
  ```
  MOD MPGRP: SRN=0, SN=26, BRDTYPE=POUc, MPGRPN=0, IPHC=UDP/IP_HC;
  ```

NOTE

If the BSC uses IP over FE/GE transmission:

- Enable the IPHC function for the routers and then for the BTSs.
- Do not enable the IPHC function for the BSC.
- Enable the routers to support the IPHC function only for UDP packet headers.

Deactivation Command Examples

- eNodeB/NodeB/eGBTS
  ```
  //Deactivating IPHC for a PPP link
  MOD PPPLNK: CN=0, SRN=0, SN=6, SBT=BASE_BOARD, PPPLNKN=0, PN=0, IPHC=DISABLE;
  //Deactivating IPHC for an MLPPP group
  MOD MPGRP: CN=0, SRN=0, SN=7, SBT=BASE_BOARD, MPGRPN=0, IPHC=DISABLE;
  ```
- GBTS
  ```
  //Deactivating Abis IPHC for a PPP link
  MOD BTSPPPLNK: IDTYPE=BYID, BTSID=200, PPPLNKN=0, IPHC= DISABLE;
  //Deactivating Abis IPHC for an MLPPP group
  MOD BTSMPGRP: IDTYPE=BYID, BTSID=200, MPGRPN=0, IPHC= DISABLE;
  ```
- Base station controller
  ```
  //Deactivating IPHC for a PPP link (setting Subrack No. and Slot No. to the
  subrack number and slot number of the POUc board)
  MOD PPPLNK: SRN=0, SN=26, BRDTYPE=POUc, PPPLNKN=0, IPHC=No_HC;
  //Deactivating IPHC for an MLPPP group (setting Subrack No. and Slot No. to
  the subrack number and slot number of the POUc board)
  MOD MPGRP: SRN=0, SN=26, BRDTYPE=POUc, MPGRPN=0, IPHC=No_HC;
  MOD MPGRP: SRN=0, SN=26, BRDTYPE=POUc, MPGRPN=0, IPHC=No_HC;
  ```

5.2.4.2.3 Using the CME

This feature can be activated using the CME. This section uses the eNodeB as an example. For detailed operations, see CME-based Feature Configuration or the CME online help (click  on the wizard interface).

Configuration Type	CME Online Help
Single configuration	**CME Management** > **CME Guidelines** > **Getting Started with the CME** > **Introduction to Data Configuration Operations**
Batch eGBTS configuration	**CME Management** > **CME Guidelines** > **GSM Application Management** > **Base Station Related Operations** > **Importing and Exporting eGBTS Data for Batch Reconfiguration**

Configuration Type	CME Online Help
Batch NodeB configuration	**CME Management** > **CME Guidelines** > **UMTS Application Management** > **NodeB Related Operations** > **Importing and Exporting NodeB Data for Batch Configuration**
Batch eNodeB configuration	**CME Management** > **CME Guidelines** > **LTE Application Management** > **eNodeB Related Operations** > **Importing and Exporting eNodeB Data for Batch Configuration**

5.2.4.3 Activation Verification

eNodeB/NodeB/eGBTS

Step 1 Check the activation status.

Run the **DSP PPPLNK** command, and then check the command output. If the value of **Link Status** is **Up**, IPHC has been activated.

Run the **DSP MPGRP** command, and then check the command output. If the value of **MLPPP Group Status** is **Up**, IPHC has been activated.

Step 2 Observe the transmit traffic during a call.

- If the BSC and the BTS are connected using PPP or MP links, monitor the transmit traffic by configuring **Realtime Bandwidth**. For details, see "Monitoring Transmission Resources" in *BSC6900 LMT User Guide* or *BSC6910 LMT User Guide*.
- If the BSC and the BTS are connected using a router, obtain the transmit traffic from the transmission device.

  Expected result: When the traffic volume is constant, the transmit traffic when **IPHC** is set to **ENABLE(ENABLE)** is less than the transmit traffic when **IPHC** is set to **DISABLE(DISABLE)**.

----End

GBTS

Step 1 For a GBTS, run the BSC MML command **DSP BTSPPPLNK** or **DSP BTSMPGRP**.

Expected result: The value of **IPHC Negotiation Result** reported by the BTS is **ENABLE.**

Step 2 Observe the transmit traffic during a call.

- If the BSC and the BTS are connected using PPP or MP links, monitor the transmit traffic by configuring **Realtime Bandwidth** on the BSC LMT. For details, see "Monitoring Transmission Resources" in *BSC6900 LMT User Guide* or *BSC6910 LMT User Guide*.
- If the BSC and the BTS are connected using a router, obtain the transmit traffic from the transmission device.

Expected result: When the traffic volume is constant, the transmit traffic when **IPHC** is set to **ENABLE(ENABLE)** is less than the transmit traffic when **IPHC** is set to **DISABLE(DISABLE)**.

----End

Base Station Controller

Step 1 Run the **DSP PPPLNK** or **DSP MPGRP** command, and then check the command output.

Expected result: The value of **IPHC Negotiation Result** reported by the BTS is **ENABLE.**

Step 2 Observe the transmit traffic during a call.

- If the BSC and the BTS are connected using PPP or MP links, monitor the transmit traffic by configuring **Realtime Bandwidth** on the BSC LMT. For details, see "Monitoring Transmission Resources" in *BSC6900 LMT User Guide* or *BSC6910 LMT User Guide*.
- If the BSC and the BTS are connected using a router, obtain the transmit traffic from the transmission device.

  Expected result: When the traffic volume is constant, the transmit traffic when **IPHC** is set to **ENABLE(ENABLE)** is less than the transmit traffic when **IPHC** is set to **DISABLE(DISABLE)**.

----End

5.2.4.4 Network Monitoring

None

5.3 PPPHC

5.3.1 Principles

PPPHC is used to compress PPP headers. The ACFC and PFC techniques can be used together or separately. The specific techniques are negotiated during the Link Control Protocol (LCP) phase.

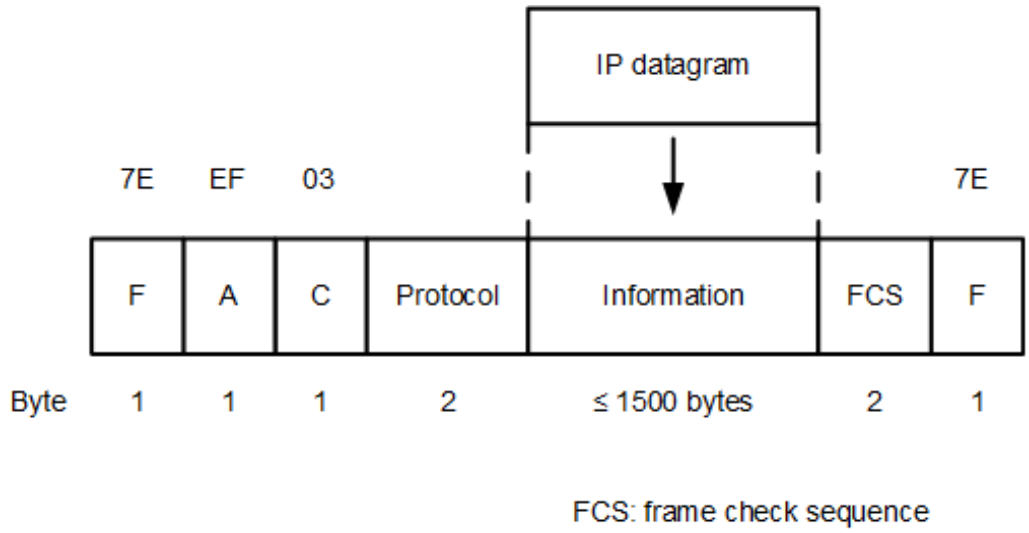
NOTE

NB-IoT does not support the PPPHC function.

PPP Frame Format

The PPP frame format is defined in RFC1661, as shown in **Figure 5-6**.

Figure 5-6 PPP frame format



The flag field (F) is 0x7E. The address field (A) and the control field (C) have fixed values of 0xFF and 0x03.

The fields of a PPP frame shown in **Figure 5-6** are described as follows:

- Flag: specifies the start or end of a frame. This field is set to a fixed value for a PPP frame.
- Address: specifies an address. This field is set to a fixed value for a PPP frame.
- Control: specifies the control field. This field is set to a fixed value for a PPP frame.
- Protocol: specifies the type of the protocol encapsulated by the information field. For example, 0x0021 indicates that an IP packet is encapsulated.
- Information (also known as payload): contains the upper-layer protocol datagram encapsulated by a PPP frame. The size of the information field varies and the maximum size is specified by the maximum receive unit (MRU). The MRU is negotiable during the PPP link establishment. If the MRU is not negotiated, the default size is 1500 bytes. Different values of the Protocol field indicate different types of information fields, as shown in **Table 5-3**.
- FCS: specifies the frame check sequence field.

Table 5-3 Mapping between the Protocol field value and information field type

Protocol Field Value	Information Field Type
0x0021	IP packet
0xC021	LCP data
0x8021	Network Control Protocol (NCP) data
0xC023	Password Authentication Protocol (PAP) data
0xC025	Link Quality Report (LQR) data

Protocol Field Value	Information Field Type
0xC223	Challenge Handshake Authentication Protocol (CHAP) data

Compression Protocols

- ACFC

  As defined in RFC1661, ACFC is used to compress the address and control fields in PPP and MLPPP frames.

  Since the address field (field A shown in **Figure 5-6**) and control field (field C shown in **Figure 5-6**) in a PPP header have fixed values during transmission, these fields can be compressed to conserve bandwidth. During link establishment, the transmit and receive ends negotiate link attributes, including whether to use ACFC. During the LCP phase, the transmit and receive ends negotiate whether to compress these fields based on the option "Address-and-Control-Field-Compression" in control messages sent on PPP links. If both ends use ACFC, the address and control fields are omitted in subsequent frames.

  On the BSC/RNC side, if ***ACFC*** for PPP links and ***ACFC*** for MLPPP links are set to **Enable**, ACFC is supported. The two ends then negotiate whether to use ACFC. If the parameters are set to **Disable**, ACFC is not supported.

  On the eNodeB/NodeB/eGBTS, the ***ACFC*** parameter specifies whether to activate ACFC for a PPP link. The ***ACFC*** parameter specifies whether to activate ACFC for an MLPPP link.

  On the GBTS, the ***ACFC*** parameter specifies whether to activate ACFC for a PPP link. The ***ACFC*** parameter specifies whether to activate ACFC for an MLPPP link.

- PFC

  As defined in RFC1661, PFC is used to compress the protocol field in PPP and MLPPP frames.

  The size of the protocol field in a PPP or MLPPP frame header (the Protocol field shown in **Figure 5-6**) is two bytes. This field specifies the type of the encapsulated protocol. For example, 0x0021 indicates that an IP packet is encapsulated. Typically, packets at the network layer, such as IP packets and compressed UDP/IP packets, have a protocol field value of less than 0xFF. In this situation, the protocol field in each header can be compressed from 2 bytes to 1 byte.

  The least significant bit of the protocol field in a PPP or MLPPP frame specifies whether to use PFC. Value **0** indicates that PFC is not used, and value **1** indicates that PFC is used.

  On the BSC/RNC, if ***PFC*** for PPP links and ***PFC*** for MLPPP links are set to **Enable**, PFC is supported. The two ends then negotiate whether to use PFC. If the parameters are set to **Disable**, PFC is not supported.

  On the eNodeB/NodeB/eGBTS, the ***PFC*** parameter specifies whether to activate PFC for a PPP link. The ***PFC*** parameter specifies whether to activate PFC for an MLPPP link.

  On the GBTS, the ***PFC*** parameter specifies whether to activate PFC for a PPP link. The ***PFC*** parameter specifies whether to activate PFC for an MLPPP link.

5.3.2 Network Analysis

5.3.2.1 Benefits

The transmission efficiency can be improved by compressing the PPP frame header address, control field, or protocol field.

5.3.2.2 Impacts

Network Impacts

None

Function Impacts

None

5.3.3 Requirements

5.3.3.1 Licenses

None

5.3.3.2 Software

Prerequisite Functions

None

Mutually Exclusive Functions

None

5.3.3.3 Hardware

Base Station Models

The following base stations are compatible with this function:

- 3900 and 5900 series base stations
- DBS3900 LampSite and DBS5900 LampSite

Boards

- LBFD-003004/TDLBFD-003004/MLBFD-003004 Compression & Multiplexing over E1/T1 for LTE

  The eNodeB must be configured with the UMPT board. The LMPT board does not support PPPHC.
- PPPHC for GSM
  - To support PPP MUX for a PPP link, the BSC6900 must be configured with the PEUa/PEUc/POUc board and The BSC6910 must be configured with the POUc board.

  - To support PPP MUX for an MLPPP group, the BSC6900 must be configured with the PEUa/PEUc/POUc board and The BSC6910 must be configured with the POUc board.
  - The eGBTS must be configured with the UTRP/UMPT/GTMUb/GTMUc board.
  - For the GBTS, 3012 series base stations must be configured with the DPTU board and 3900 and 5900 series base stations must be configured with the GTMUb/GTMUc board.
- PPPHC for UMTS
  - To support PPP MUX for a PPP link, the BSC6900 must be configured with the PEUa/PEUc/POUa/UOIa/POUc board.
  - To support PPP MUX for an MLPPP group, the BSC6900 must be configured with the PEUa/PEUc/POUa/POUc board.
  - The NodeB must be configured with the UTRP/UMPT/WMPT board.

RF Modules

None

5.3.3.4 Networking

IP over E1/T1 is applied between devices at the two ends that use PPPHC.

5.3.3.5 Others

- eNodeB/NodeB/eGBTS

  The peer equipment connected to the eNodeB/NodeB/eGBTS supports IP over E1/T1 and PPPHC.
- GBTS

  The peer equipment connected to the GBTS supports IP over E1/T1 and PPPHC.
- Base station controller

  The peer equipment connected to the base station controller supports IP over E1/T1 and PPPHC.

5.3.4 Operation and Maintenance

5.3.4.1 Data Configuration

5.3.4.1.1 Data Preparation

eNodeB/NodeB/eGBTS

- PPPHC for a PPP link

  The following table describes the key parameters that must be set in a **PPPLNK** MO to configure PPPHC for a PPP link. The cabinet number, subrack number, and slot number of the PPP link must be the same as those of the board where the link is located. If a UMPT board provides the transmission port, set the subboard type of the PPP link to **BASE_BOARD(Base Board)**.

Parameter Name	Parameter ID	Setting Notes
Link No.	**PPPLNK.*PPPLNKN***	Each PPP link/MLPPP link must have a unique link number.
Port No.	**PPPLNK.*PN***	Set this parameter based on the actual connection and the peer configuration.
Authentication Type	**PPPLNK.*AUTH***	Set this parameter to be consistent with the setting at the peer end.
User Name	**PPPLNK.*UN***	These parameters are valid only when the **PPPLNK.*AUTH*** parameter is not set to **NONAUTH(No Authentication)**. Set these parameters to be consistent with the settings at the peer end.
Password	**PPPLNK.*PWD***	
Time Slot No.	**PPPLNK.*TSN***	Set this parameter to be consistent with the setting at the peer end.
Local IP	**PPPLNK.*LOCALIP***	Set this parameter based on the network plan.
Mask	**PPPLNK.*IPMASK***	Set this parameter based on the network plan.
Peer IP	**PPPLNK.*PEERIP***	Set this parameter based on the network plan.
PPPMUX	**PPPLNK.*MUXCP***	Set this parameter to be consistent with the setting at the peer end.
IP Header Compression	**PPPLNK.*IPHC***	Set this parameter to be consistent with the setting at the peer end.
Maximum Receive Unit	**PPPLNK.*IPHCSUBOPT***	Set this parameter based on the network plan.

- PPPHC for an MLPPP group

  For information about the parameters that must be set in an **MPGRP** MO to configure PPPHC for an MLPPP group, see "IPHC for an MLPPP Group" in **5.2.4.2.1 Data Preparation**.

  The following table describes the key parameters that must be set in an **MPLNK** MO to configure PPPHC for an MLPPP link in an MLPPP group. The cabinet number, subrack number, and slot number of the MLPPP link must be the same as those of the board where the link is located. If a UMPT board provides the transmission port, set the subboard type of the MLPPP link to **BASE_BOARD(Base Board)**.

Parameter Name	Parameter ID	Setting Notes
Link No.	**MPLNK.*PPPLNKN***	Each MLPPP link/PPP link must have a unique link number.
MLPPP Group Subboard Type	**MPLNK.*MPGRPSBT***	Set this parameter to **E1_COVERBOARD(E1 Cover Board)** or **BASE_BOARD(Base Board)** based on the actual situations.
MLPPP Group No.	**MPLNK.*MPGRPN***	Each MLPPP group must have a unique group number.
E1/T1 Subrack No.	**MPLNK.*E1T1SRN***	Set these parameters based on the actual situations.
E1/T1 Slot No.	**MPLNK.*E1T1SN***	
E1/T1 Subboard Type	**MPLNK.*E1T1SBT***	Set this parameter to **E1_COVERBOARD(E1 Cover Board)** or **BASE_BOARD(Base Board)** based on the actual situations.
E1/T1 Port No.	**MPLNK.*E1T1PN***	Set this parameter based on the actual connection and the peer configuration.
Time Slot No.	**MPLNK.*TSN***	Set this parameter to be consistent with the setting at the peer end.
Maximum Receive Unit	**MPLNK.*MRU***	Set this parameter based on the network plan.
Protocol Field Compression	**MPLNK.*PFC***	Set this parameter to **ENABLE** at local and peer ends.
Address and Control Field Compression	**MPLNK.*ACFC***	Set this parameter to **ENABLE** at local and peer ends.

GBTS

- PPPHC for a PPP link

  The following table describes the key parameters that must be set in a **BTSPPPLNK** MO to configure PPPHC for a PPP link. The cabinet number, subrack number, and slot number of the PPP link must be the same as those of the board where the link is located.

Parameter Name	Parameter ID	Setting Notes
PPP Link No.	**BTSPPPLNK.*PPPLNKN***	Each PPP link/MLPPP link must have a unique link number.
Port No.	**BTSPPPLNK.*PN***	Set this parameter based on the actual connection and the peer configuration.
Bearing Time Slot	**BTSPPPLNK.*TSBITMAP***	Set this parameter to be consistent with the setting at the peer end.
Local IP Address	**BTSPPPLNK.*LOCALIP***	Set this parameter based on the network plan.
Subnet Mask	**BTSPPPLNK.*MASK***	Set this parameter based on the network plan.
Peer IP Address	**BTSPPPLNK.*PEERIP***	Set this parameter based on the network plan.
Validate Protocol Type	**BTSPPPLNK.*AUTHTYPE***	Set this parameter to be consistent with the setting at the peer end.
Validate User Name	**BTSPPPLNK.*AUTHNAME***	These parameters are valid only if the **BTSPPPLNK.*AUTHTYPE*** parameter is not set to **NO_V(No Validate)**. Set these parameters to be consistent with the settings at the peer end.
Validate Password	**BTSPPPLNK.*AUTHPWD***	
Validate Mode	**BTSPPPLNK.*AUTHMODE***	
IP Header Compression	**BTSPPPLNK.*IPHC***	Set this parameter to be consistent with the setting at the peer end.

- PPPHC for an MLPPP group

  The following table describes the key parameters that must be set in a **BTSMPGRP** MO to configure PPPHC for an MLPPP group. The cabinet number, subrack number, and slot number of the MLPPP group must be the same as those of the board where the group is located.

Parameter Name	Parameter ID	Setting Notes
MLPPP Group No.	**BTSMPGRP.*MPGRPN***	Set this parameter based on the network plan.
Local IP Address	**BTSMPGRP.*LOCALIP***	Set this parameter based on the network plan.
Subnet Mask	**BTSMPGRP.*MASK***	Set this parameter based on the network plan.

Parameter Name	Parameter ID	Setting Notes
Peer IP Address	**BTSMPGRP.*PEERIP***	Set this parameter based on the network plan.
MCPPP Switch	**BTSMPGRP.*MPSWITCH***	Set this parameter to be consistent with the setting at the peer end.
MP/MC List Head Option	**BTSMPGRP.*MHF***	Set this parameter based on the network plan.
Validate Protocol Type	**BTSMPGRP.*AUTHTYPE***	Set this parameter to be consistent with the setting at the peer end.
Support Protocol Field Compress	**BTSMPGRP.*PFC***	Set this parameter to **YES** at local and peer ends.
Support Address and Control Field Compress	**BTSMPGRP.*ACFC***	Set this parameter to **YES** at local and peer ends.
IP Header Compression	**BTSMPGRP.*IPHC***	Set this parameter to be consistent with the setting at the peer end.

The following table describes the key parameters that must be set in a **BTSMPLNK** MO to configure PPPHC for an MLPPP link in the MLPPP group. The cabinet number, subrack number, and slot number of the MLPPP link must be the same as those of the board where the link is located.

Parameter Name	Parameter ID	Setting Notes
MLPPP Group No.	**BTSMPLNK.*MPGRPN***	Each PPP link/MLPPP link must have a unique link number.
PPP Link No.	**BTSMPLNK.*PPPLNKN***	Each PPP link/MLPPP link must have a unique link number.
Port No.	**BTSMPLNK.*PN***	Set this parameter based on the actual connection and the peer configuration.
Bearing Time Slot	**BTSMPLNK.*TSBITMAP***	Set this parameter to be consistent with the setting at the peer end.
Max Receive Unit	**BTSMPLNK.*MRU***	Set this parameter based on the network plan.
Restart Timer	**BTSMPLNK.*RSTIME***	The default value is recommended.

On the Base Station Controller Side

- PPPHC for a PPP link

  The following table describes the key parameters that must be set in a **PPPLNK** MO to configure PPPHC for a PPP link. The subrack number and slot number of the PPP link must be the same as those of the board where the link is located.

Parameter Name	Parameter ID	Setting Notes
PPP link No.	**PPPLNK.*PPPLNKN***	Each PPP link/MLPPP link must have a unique link number.
E1/T1 port No.	**PPPLNK.*DS1***	Set this parameter based on the actual connection and the peer configuration.
Bearing time slot	**PPPLNK.*TSBITMAP***	Set this parameter to be consistent with the setting at the peer end.
Borrow DevIP	**PPPLNK.*BORROWDEVIP***	Set this parameter based on the network plan.
Borrowed device IP address	**PPPLNK.*DEVIP***	This parameter is valid only if the **PPPLNK**.***BORROWDEVIP*** parameter is not set to **YES**.
Local IP address	**PPPLNK.*LOCALIP***	Set this parameter based on the network plan.
Subnet Mask	**PPPLNK.*MASK***	Set this parameter based on the network plan.
Peer IP address	**PPPLNK.*PEERIP***	Set this parameter based on the network plan.
Head compress	**PPPLNK.*IPHC***	Set this parameter to be consistent with the setting at the peer end.
Protocol field compress	**PPPLNK.*PFC***	Set this parameter to **ENABLE** at local and peer ends.
Address and Control Field Compress	**PPPLNK.*ACFC***	Set this parameter to **ENABLE** at local and peer ends.
PPP mux	**PPPLNK.*PPPMUX***	Set this parameter to be consistent with the setting at the peer end.
Validate protocol type	**PPPLNK.*AUTHTYPE***	Set this parameter to be consistent with the setting at the peer end.
Validate user name	**PPPLNK.*AUTHNAME***	These parameters are valid only if the **PPPLNK**.***AUTHTYPE*** parameter is not set to **NO_V(NO_V)**. Set these parameters
Validate password	**PPPLNK.*AUTHPWD***	

Parameter Name	Parameter ID	Setting Notes
Validate mode	**PPPLNK.*AUTHMODE***	to be consistent with the settings at the peer end.

- PPPHC for an MLPPP group

  The following table describes the key parameters that must be set in an **MPGRP** MO to configure PPPHC for an MLPPP group. The subrack number and slot number of the MLPPP group must be the same as those of the board where the group is located.

Parameter Name	Parameter ID	Setting Notes
MP Group No.	**MPGRP.*MPGRPN***	Set this parameter based on the network plan.
MP type	**MPGRP.*MPTYPE***	Set this parameter to be consistent with the setting at the peer end.
Borrow DevIP	**MPGRP.*BORROWDEVIP***	Set this parameter based on the network plan.
Borrowed device IP address	**MPGRP.*DEVIP***	This parameter is valid only if the **MPGRP.*BORROWDEVIP*** parameter is not set to **YES**.
Local IP address	**MPGRP.*LOCALIP***	Set this parameter based on the network plan.
Subnet Mask	**MPGRP.*MASK***	Set this parameter based on the network plan.
MP/MC list head option	**MPGRP.*MHF***	Set this parameter based on the network plan.
MC PRI Number	**MPGRP.*MCCLASS***	This parameter is valid only if the **MPGRP.*MPTYPE*** parameter is set to **MCPPP**.
Head compress	**MPGRP.*IPHC***	Set this parameter to be consistent with the setting at the peer end.
Protocol field compress	**MPGRP.*PFC***	Set this parameter to **ENABLE** at local and peer ends.
Address and Control Field Compress	**MPGRP.*ACFC***	Set this parameter to **ENABLE** at local and peer ends.
PPP mux	**MPGRP.*PPPMUX***	Set this parameter to be consistent with the setting at the peer end.

Parameter Name	Parameter ID	Setting Notes
PPP mux max sub-frame length	**MPGRP.*MAXSFLEN***	These parameters are valid only if the **MPGRP.*PPPMUX*** parameter is set to **ENABLE**. Set these parameters based on the network plan.
PPP mux max mux-frame length	**MPGRP.*MAXMFLEN***	
PPP mux framing out-time[us]	**MPGRP.*MUXTIME***	

The following table describes the key parameters that must be set in an **MPLNK** MO to configure PPPHC for an MLPPP link in the MLPPP group. The subrack number and slot number of the MLPPP link must be the same as those of the board where the link is located.

Parameter Name	Parameter ID	Setting Notes
MP Group No.	**MPLNK.*MPGRPN***	Each PPP link/MLPPP link must have a unique link number.
PPP sub-link No.	**MPLNK.*PPPLNKN***	Each PPP link/MLPPP link must have a unique link number.
E1/T1 port No.	**MPLNK.*DS1***	Set this parameter based on the actual connection and the peer configuration.
Bearing time slot	**MPLNK.*TSBITMAP***	Set this parameter to be consistent with the setting at the peer end.
CRC check mode	**MPLNK.*FCSTYPE***	Set this parameter based on the network plan.

5.3.4.1.2 Using MML Commands

Activation Command Examples

On the eNodeB/NodeB/eGBTS side:

- PPPHC for a PPP link

```
ADD PPPLNK: CN=0, SRN=0, SN=6, SBT=BASE_BOARD, PPPLNKN=0, PN=0, AUTH=NONAUTH,
TSN=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&TS12-1
&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22-1&TS23-1&
TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1,
LOCALIP="192.168.20.3", IPMASK="255.255.255.0", PEERIP="192.168.20.75",
MUXCP=ENABLE, PFC=ENABLE, ACFC=ENABLE;
```

- PPPHC for an MLPPP group


```
ADD MPGRP: CN=0, SRN=0, SN=7, SBT=BASE_BOARD, MPGRPN=0, AUTH=NONAUTH,
LOCALIP="192.168.20.3", IPMASK="255.255.255.0", PEERIP="192.168.20.75",
MUXCP=ENABLE, IPHC=ENABLE, MCPPP=ENABLE, MHO=LONG;
ADD MPLNK: CN=0, SRN=0, SN=7, SBT=BASE_BOARD, PPPLNKN=0, MPGRPN=0,
MPGRPSBT=BASE_BOARD, E1T1SRN=0, E1T1SN=7, E1T1SBT=BASE_BOARD, E1T1PN=0,
TSN=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&TS12-1
&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22-1&TS23-1&
TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1, PFC=ENABLE,
ACFC=ENABLE;
```

On the GBTS side:

- PPPHC for a PPP link

```
ADD BTSPPPLNK: IDTYPE=BYID, BTSID=0, PPPLNKN=0, PN=0, CN=0, SRN=0, SN=6,
TSBITMAP=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&T
S12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22-1&TS
23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1,
LOCALIP="192.168.20.3", MASK="255.255.255.0", PEERIP="192.168.20.75",
AUTHTYPE=NO_V;
```

- PPPHC for an MLPPP group

```
ADD BTSMPGRP: IDTYPE=BYID, BTSID=0, MPGRPN=0, CN=0, SRN=0, SN=7,
LOCALIP="192.168.20.3", MASK="255.255.255.0", PEERIP="192.168.20.75",
MPSWITCH=ENABLE, MHF=LONG, AUTHTYPE=NO_V, PFC=YES, ACFC=YES, IPHC=ENABLE;
ADD BTSMPLNK: IDTYPE=BYNAME, BTSNAME="0", MPGRPN=0, PPPLNKN=0, PN=0, CN=0,
SRN=0, SN=7,
TSBITMAP=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&T
S12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22-1&TS
23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1;
```

On the base station controller side:

- PPPHC for a PPP link

```
ADD PPPLNK: SRN=0, SN=6, BRDTYPE=POUc, PPPLNKN=0, DS1=0,
TSBITMAP=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&T
S12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22-1&TS
23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1, BORROWDEVIP=NO,
LOCALIP="192.168.20.75", MASK="255.255.255.0", PEERIP="192.168.20.3",
PFC=Enable, ACFC=Enable, PPPMUX=Enable, AUTHTYPE=NO_V, FLOWCTRLSWITCH=ON,
ERRDETECTSW=OFF, OPSEPFLAG=OFF;
```

- PPPHC for an MLPPP group

```
ADD MPGRP: SRN=0, SN=21, BRDTYPE=POUc, MPGRPN=0, MPTYPE=MLPPP,
BORROWDEVIP=NO, LOCALIP="192.168.20.75", MASK="255.255.255.0",
PEERIP="192.168.20.3", PFC=Enable, ACFC=Enable, PPPMUX=Enable,
FLOWCTRLSWITCH=ON, AUTHTYPE=NO_V, ERRDETECTSW=OFF, ANTIERRFLAG=OFF,
OPSEPFLAG=OFF;
ADD MPLNK: SRN=0, SN=7, BRDTYPE=POUc, MPGRPN=0, PPPLNKN=0, DS1=0,
TSBITMAP=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&T
S12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22-1&TS
23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1;
```

5.3.4.1.3 Using the CME

This feature can be activated using the CME. This section uses the eNodeB as an example. For detailed operations, see CME-based Feature Configuration or the CME online help (click  on the wizard interface).

Configuration Type	CME Online Help
Single configuration	**CME Management** > **CME Guidelines** > **Getting Started with the CME** > **Introduction to Data Configuration Operations**

Configuration Type	CME Online Help
Batch eGBTS configuration	**CME Management** > **CME Guidelines** > **GSM Application Management** > **Base Station Related Operations** > **Importing and Exporting eGBTS Data for Batch Reconfiguration**
Batch NodeB configuration	**CME Management** > **CME Guidelines** > **UMTS Application Management** > **NodeB Related Operations** > **Importing and Exporting NodeB Data for Batch Configuration**
Batch eNodeB configuration	**CME Management** > **CME Guidelines** > **LTE Application Management** > **eNodeB Related Operations** > **Importing and Exporting eNodeB Data for Batch Configuration**

5.3.4.2 Activation Verification

eNodeB/NodeB/eGBTS

- PPPHC for a PPP link

  Run the **DSP PPPLNK** command, and then check the command output. If the value of **Link Status** is **Up**, PPPHC for the PPP link has been activated.

- PPPHC for an MLPPP group

  Run the **DSP MPGRP** command, and then check the command output. If the value of **MLPPP Group Status** is **Up**, PPPHC for the MLPPP group has been activated.

GBTS

- PPPHC for a PPP link

Run the **DSP BTSPPPLNK** command, and then check the command output. If the value of **Link Status** is **Up**, PPPHC for the PPP link has been activated.

- PPPHC for an MLPPP group

Run the **DSP BTSMPGRP** command, and then check the command output. If the value of **MLPPP Group Status** is **Up**, PPPHC for the MLPPP group has been activated.

On the Base Station Controller Side

- PPPHC for a PPP link

Run the **DSP PPPLNK** command, and then check the command output. If the value of **Link Status** is **Up**, PPPHC for the PPP link has been activated.

- PPPHC for an MLPPP group

Run the **DSP MPGRP** command, and then check the command output. If the value of **MLPPP Group Status** is **Up**, PPPHC for the MLPPP group has been activated.

5.3.4.3 Network Monitoring

None

6 MLPPP/MC-PPP

6.1 Principles

MLPPP (also called MP) is an extension of the PPP protocol. It is a data link layer protocol that exists between the PPP layer and the network layer. MLPPP stands for Multi-Link Point-to-Point Protocol.

MLPPP is used to combine multiple PPP links (also called MLPPP links) into one logical link. MLPPP fragments upper-layer packets and then transmits the fragmented packets over MLPPP links, increasing transmission efficiency.

MC-PPP is an extension of MLPPP. MC-PPP stands for Multi-Class Point-to-Point Protocol. MC-PPP prioritizes packets and then fragments the packets in descending order of priority, providing more service classes compared with MLPPP.

PPP defines the standard method of encapsulating IP packets on point-to-point links. The point-to-point links include the E1/T1 links and SDH links. E1/T1 ports use the PPP protocol at the data link layer. The PPP protocol has two disadvantages:

- Each PPP link corresponds to only one E1 link. If multiple E1 links are used as transport bearers, multiple PPP links must be configured. On a live network, the services with heavy traffic require bandwidths of more than one E1 link.
- PPP frames are transmitted in sequence. As a result, high-priority frames may fail to be transmitted because the network is congested with a large number of low-priority frames, resulting in end-to-end performance deterioration.

To address the preceding problems, the MLPPP/MC-PPP technique is used to increase the transmission bandwidths, enhance transmission reliability, and ensure the transmission priority.

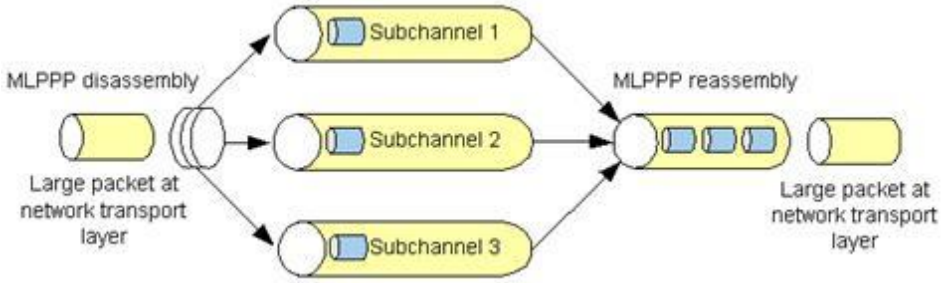
MLPPP

Data Transmission Mechanism

MLPPP is used to combine multiple PPP links into one logical link. MLPPP fragments IP packets and then transmits the fragmented packets over MLPPP links. In this manner, the bandwidth is increased and the transmission delay is reduced.

Figure 6-1 shows the MLPPP process, in which a large packet is fragmented into small packets, and the small packets are transmitted on different physical links.

Figure 6-1 MLPPP process



Frame Format

The MLPPP frame format is defined in RFC1990. The MLPPP frame has two formats: with a long sequence number and with a short sequence number, as shown in **Figure 6-2** and **Figure 6-3** respectively.

Figure 6-2 MLPPP frame format with a long sequence number

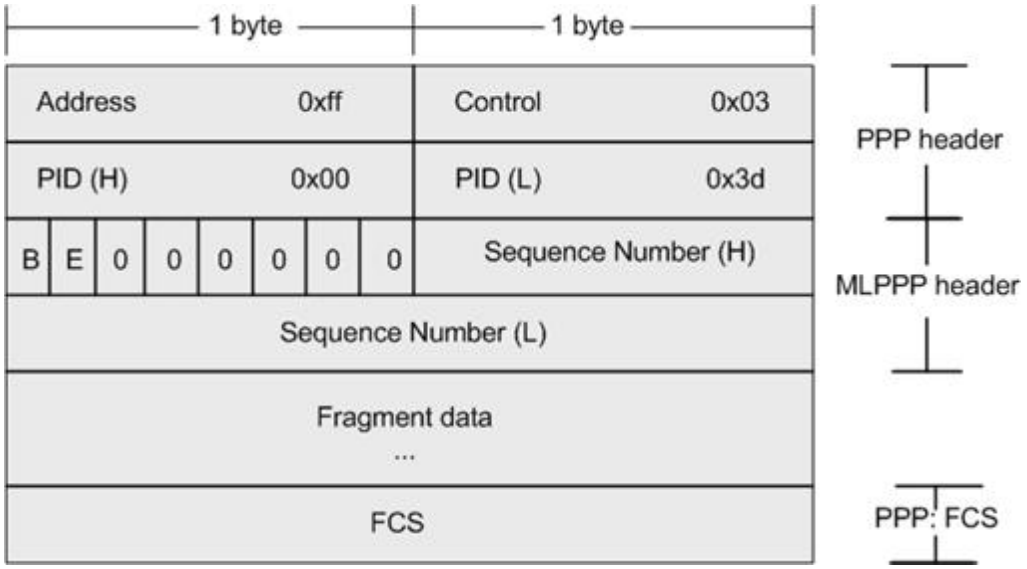
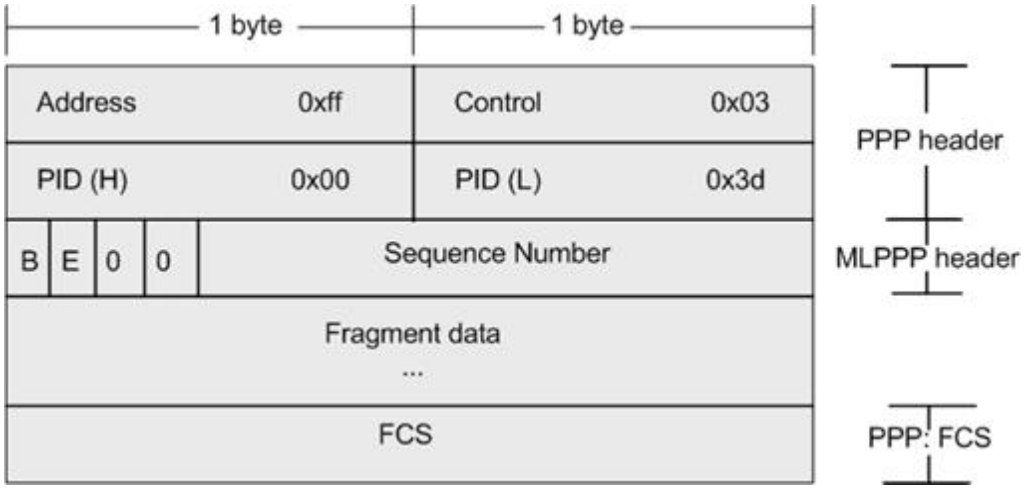


Figure 6-3 MLPPP frame format with a short sequence number



The fields of the MLPPP frame header are described as follows:

- B: beginning fragment bit (one bit) This field specifies whether an MLPPP frame is the first fragment of a PPP frame.
- E: ending fragment bit (one bit) This field specifies whether an MLPPP frame is the last fragment of a PPP frame.

MCPPP

MC-PPP (also called MC) is an extended protocol on the basis of MLPPP. By using the reserved bits in the MLPPP packets, MC-PPP grants priorities to the packets transmitted at the link convergence layer. Therefore, the packets with higher real-time requirements or higher priorities can be transmitted preferentially, while other packets are suspended. For details about MC-PPP, see RFC 2686.

The MLPPP technology divides a large packet into small packets and has each of the small packets transmitted on different physical links. If the delays vary on different physical links, the packets may be out of order. To ensure the correct sequence of packets, MLPPP/MC-PPP provides sequence numbers for the disassembled packets (small packets). MLPPP/MC-PPP provides long sequences and short sequences. Long sequences have a maximum of 16 MC-PPP priorities. Short sequences have a maximum of four MC-PPP priorities.

Currently, the base station controller and base station support different numbers of MC-PPP priorities as follows:

- If long sequences are used, 8 or 4 MC-PPP priorities are supported.
- If short sequences are used, 4 MC-PPP priorities are supported.

6.2 Network Analysis

6.2.1 Benefits

None

6.2.2 Impacts

Network Impacts

None

Function Impacts

None

6.3 Requirements

6.3.1 Licenses

None

6.3.2 Software

Prerequisite Functions

Function Name	Description
MLPPP	MC-PPP must be used along with MLPPP, while MLPPP can be used alone.

Mutually Exclusive Functions

None

6.3.3 Hardware

Base Station Models

The following base stations are compatible with this function:

- 3900 and 5900 series base stations
- DBS3900 LampSite and DBS5900 LampSite

Boards

- LBFD-00300403/TDLBFD-00300403/MLBFD-00300403 ML-PPP/MC-PPP for LTE

  The eNodeB must be configured with the UMPT board. The LMPT board does not support MLPPP.
- MLPPP/MC-PPP function for GSM
  - The BSC6900 must be configured with the PEUa/PEUc/POUc board.
  - The BSC6910 must be configured with the POUc board.
  - The eGBTS must be configured with the UTRP/UMPT/GTMUb/GTMUc board.

  - For the GBTS, 3012 series base stations must be configured with the DPTU board and 3900 and 5900 series base stations must be configured with the GTMUb/GTMUc board.
- MLPPP/MC-PPP function for UMTS
  - The BSC6900 must be configured with the PEUa/PEUc/POUa/POUc board.
  - The BTS3900 or BTS5900 must be configured with the UTRP/UMPT/WMPT board.

RF Modules

None

6.3.4 Networking

IP over E1/T1 is applied to devices at the two ends where MLPPP/MC-PPP is used.

6.3.5 Others

- eNodeB/NodeB/eGBTS

  The peer equipment connected to the eNodeB/NodeB/eGBTS supports IP over E1/T1 and MLPPP/MC-PPP.
- GBTS

  The peer equipment connected to the GBTS supports IP over E1/T1 and MLPPP/MC-PPP.
- Base station controller

  The peer equipment connected to the base station controller supports IP over E1/T1 and MLPPP/MC-PPP.

6.4 Operation and Maintenance

6.4.1 When to Use

MC-PPP is recommended if packet forwarding efficiency is required to be improved and more service classes are required.

MLPPP is recommended if the throughput is required to be increased and the transmission delay is required to be reduced.

6.4.2 Data Configuration

6.4.2.1 Data Preparation

eNodeB/NodeB/eGBTS

- MC-PPP

  The following table describes the key parameters that must be set in an **MPGRP** MO to configure MC-PPP for an MLPPP group. The cabinet number, subrack number, and slot number of the MLPPP group must be the same as those of the board where the group is

located. If a UMPT board provides the transmission port, set the subboard type of the MLPPP group to **BASE_BOARD(Base Board)**.

Parameter Name	Parameter ID	Setting Notes
PPPMUX	**MPGRP.*MUXCP***	Set this parameter based on the network plan.
PPP Mux Subframe Max Length	**MPGRP.*MAXSFLEN***	These parameters are valid only if the **MPGRP**.***MUXCP*** parameter is set to **ENABLE**. Set these parameters based on the network plan.
PPP Muxframe Max Length	**MPGRP.*MAXMFLEN***	
PPPMUX Combine Timeout	**MPGRP.*MUXTIME***	
IP Header Compression	**MPGRP.*IPHC***	Set this parameter to be consistent with the setting at the peer end.
Multi-Class PPP	**MPGRP.*MCPPP***	Set this parameter to **ENABLE** at local and peer ends.
MP/MC Header Option	**MPGRP.*MHO***	These parameters are valid only if the **MPGRP**.***MCPPP*** parameter is set to **ENABLE**.
MCPPP Class	**MPGRP.*MCCLASS***	

The following table describes the key parameters that must be set in an **MPLNK** MO to configure MC-PPP for an MLPPP link in an MLPPP group. Before adding an MLPPP link to a specific MLPPP group, ensure that the MLPPP group has been configured. The cabinet number, subrack number, and slot number of an E1/T1 port must be the same as those of the board where the port is located. If a UMPT board provides the transmission port, set the subboard types of the MLPPP link, MLPPP group, and E1/T1 port to **BASE_BOARD(Base Board)**.

Parameter Name	Parameter ID	Setting Notes
Link No.	**MPLNK**.***PPPLNKN***	Each MLPPP link in an MLPPP group must have a unique link number.
MLPPP Group No.	**MPLNK**.***MPGRPN***	Each MLPPP group must have a unique group number.
Timeslot No.	**MPLNK**.***TSN***	Set this parameter based on the network plan.
Maximum Receive Unit	**MPLNK**.***MRU***	Set this parameter based on the network plan.

Parameter Name	Parameter ID	Setting Notes
Protocol Field Compression	**MPLNK.*PFC***	Set this parameter to be consistent with the setting at the peer end.
Address and Control Field Compression	**MPLNK.*ACFC***	Set this parameter to be consistent with the setting at the peer end.
Negotiation Time	**MPLNK.*RESTARTTMR***	The default value is recommended.

- MLPPP

  Before deploying MLPPP, add an MLPPP group and then add MLPPP links to the MLPPP group.

  The following table describes the key parameters that must be set in an **MPGRP** MO to configure MLPPP for an MLPPP group. The cabinet number, subrack number, and slot number of the MLPPP group must be the same as those of the board where the group is located.

Parameter Name	Parameter ID	Setting Notes
PPPMUX	**MPGRP.*MUXCP***	Set this parameter to be consistent with the setting at the peer end.
PPP Mux Subframe Max Length	**MPGRP.*MAXSFLEN***	These parameters are valid only if the **MPGRP.*MUXCP*** parameter is set to **ENABLE**. Set these parameters based on the network plan.
PPP Muxframe Max Length	**MPGRP.*MAXMFLEN***	
PPPMUX Combine Timeout	**MPGRP.*MUXTIME***	
IP Header Compression	**MPGRP.*IPHC***	Set this parameter based on the network plan.
Multi-Class PPP	**MPGRP.*MCPPP***	Set this parameter to be consistent with the setting at the peer end.
MP/MC Header Option	**MPGRP.*MHO***	These parameters are valid only if the **MPGRP.*MCPPP*** parameter is set to **ENABLE**.
MCPPP Class	**MPGRP.*MCCLASS***	

  Add an MLPPP link.

  The following table describes the key parameters that must be set in an **MPLNK** MO to configure add an MLPPP link. The cabinet number, subrack number, and slot number of

the MLPPP link must be the same as those of the board where the link is located. If a UMPT board provides the transmission port, set the subboard type of the MLPPP link to **BASE_BOARD(Base Board)**.

Parameter Name	Parameter ID	Setting Notes
Link No.	**MPLNK.*PPPLNKN***	Each MLPPP or PPP link must have a unique link number.
MLPPP Group Subboard Type	**MPLNK.*MPGRPSBT***	Set this parameter to **E1_COVERBOARD(E1 Cover Board)** or **BASE_BOARD(Base Board)** based on the actual situations.
MLPPP Group No.	**MPLNK.*MPGRPN***	Each MLPPP group must have a unique group number.
E1/T1 Subrack No.	**MPLNK.*E1T1SRN***	Set these parameters based on the actual situations.
E1/T1 Slot No.	**MPLNK.*E1T1SN***	
E1/T1 Subboard Type	**MPLNK.*E1T1SBT***	Set this parameter to **E1_COVERBOARD(E1 Cover Board)** or **BASE_BOARD(Base Board)** based on the actual situations.
E1/T1 Port No.	**MPLNK.*E1T1PN***	Set this parameter based on the actual connection and the peer configuration.
Timeslot No.	**MPLNK.*TSN***	Set this parameter to be consistent with the setting at the peer end.
Maximum Receive Unit	**MPLNK.*MRU***	Set this parameter based on the network plan.
Protocol Field Compression	**MPLNK.*PFC***	Set this parameter based on the network plan.
Address and Control Field Compression	**MPLNK.*ACFC***	Set this parameter based on the network plan.

GBTS

- MC-PPP

  The following table describes the key parameters that must be set in a **BTSMPGRP** MO to add an MLPPP group. The cabinet number, subrack number, and slot number of the MLPPP group must be the same as those of the board where the group is located.

Parameter Name	Parameter ID	Setting Notes
MCPPP Switch	**BTSMPGRP.*MPSWITCH***	Set this parameter to **ENABLE** at local and peer ends.
MP/MC Header Option	**BTSMPGRP.*MHF***	Set this parameter based on the network plan.
MCPPP Class	**BTSMPGRP.*MCCLASS***	These parameters are valid only if the **BTSMPGRP.*MPSWITCH*** parameter is set to **ENABLE**.
Support Protocol Field Compress	**BTSMPGRP.*PFC***	Set this parameter to be consistent with the setting at the peer end.
Support Address and Control Field Compress	**BTSMPGRP.*ACFC***	Set this parameter to be consistent with the setting at the peer end.
IP Header Compression	**BTSMPGRP.*IPHC***	Set this parameter to be consistent with the setting at the peer end.

The following table describes the key parameters that must be set in a **BTSMPLNK** MO to add an MLPPP link in an MLPPP group. Before adding an MLPPP link to a specific MLPPP group, ensure that the MLPPP group has been configured. The cabinet number, subrack number, and slot number of an E1/T1 port must be the same as those of the board where the port is located.

Parameter Name	Parameter ID	Setting Notes
MLPPP Group No.	**BTSMPLNK.*MPGRPN***	Each MLPPP group must have a unique group number.
PPP Link No.	**BTSMPLNK.*PPPLNKN***	Each MLPPP link in an MLPPP group must have a unique link number.
Bearing Time Slot	**BTSMPLNK.*TSBITMAP***	Set this parameter based on the network plan.
Max Receive Unit	**BTSMPLNK.*MRU***	Set this parameter based on the network plan.
Restart Timer	**BTSMPLNK.*RSTIME***	The default value is recommended.

- MLPPP

  Before deploying MLPPP, add an MLPPP group and then add MLPPP links to the MLPPP group.

The following table describes the key parameters that must be set in a **BTSMPGRP** MO to add an MLPPP group. The cabinet number, subrack number, and slot number of the MLPPP group must be the same as those of the board where the group is located.

Parameter Name	Parameter ID	Setting Notes
MCPPP Switch	**BTSMPGRP.*MPSWITCH***	Set this parameter to **DISABLE** at local and peer ends.
MP/MC Header Option	**BTSMPGRP.*MHF***	Set this parameter based on the network plan.
Support Protocol Field Compress	**BTSMPGRP.*PFC***	Set this parameter to be consistent with the setting at the peer end.
Support Address and Control Field Compress	**BTSMPGRP.*ACFC***	Set this parameter to be consistent with the setting at the peer end.
IP Header Compression	**BTSMPGRP.*IPHC***	Set this parameter to be consistent with the setting at the peer end.

The following table describes the key parameters that must be set in a **BTSMPLNK** MO to add an MLPPP link. The cabinet number, subrack number, and slot number of the MLPPP group must be the same as those of the board where the group is located.

Parameter Name	Parameter ID	Setting Notes
MLPPP Group No.	**BTSMPLNK.*MPGRPN***	Each MLPPP group must have a unique group number.
PPP Link No.	**BTSMPLNK.*PPPLNKN***	Each MLPPP link in an MLPPP group must have a unique link number.
Bearing Time Slot	**BTSMPLNK.*TSBITMAP***	Set this parameter based on the network plan.
Max Receive Unit	**BTSMPLNK.*MRU***	Set this parameter based on the network plan.
Restart Timer	**BTSMPLNK.*RSTIME***	The default value is recommended.

On the Base Station Controller Side

- MC-PPP

  The following table describes the key parameters that must be set in an **MPGRP** MO to add an MLPPP group. The subrack number and slot number of the MLPPP group must be the same as those of the board where the group is located.

Parameter Name	Parameter ID	Setting Notes
MP type	**MPGRP.*MPTYPE***	Set this parameter to **MCPPP** at local and peer ends.
MP/MC list head option	**MPGRP.*MHF***	Set this parameter based on the network plan.
MC PRI number	**MPGRP.*MCCLASS***	This parameter is valid only if the **MPGRP.*MPTYPE*** parameter is set to **MCPPP**.
Head compress	**MPGRP.*IPHC***	Set this parameter to be consistent with the setting at the peer end.
Protocol field compress	**MPGRP.*PFC***	Set this parameter to be consistent with the setting at the peer end.
Address and Control Field Compress	**MPGRP.*ACFC***	Set this parameter to be consistent with the setting at the peer end.
PPP mux	**MPGRP.*PPPMUX***	Set this parameter to be consistent with the setting at the peer end.
PPP mux max sub-frame length	**MPGRP.*MAXSFLEN***	These parameters are valid only if the **MPGRP.*PPPMUX*** parameter is set to **ENABLE**. Set these parameters based on the network plan.
PPP mux max mux-frame length	**MPGRP.*MAXMFLEN***	
PPP mux framing out-time[us]	**MPGRP.*MUXTIME***	

The following table describes the key parameters that must be set in an **MPLNK** MO to add an MLPPP link in an MLPPP group. Before adding an MLPPP link to a specific MLPPP group, ensure that the MLPPP group has been configured. The subrack number and slot number of an E1/T1 port must be the same as those of the board where the port is located.

Parameter Name	Parameter ID	Setting Notes
MP Group No.	**MPLNK.*MPGRPN***	Each MLPPP group must have a unique group number.
PPP sub-link No.	**MPLNK.*PPPLNKN***	Each MLPPP link in an MLPPP group must have a unique link number.

Parameter Name	Parameter ID	Setting Notes
E1T1 port No.	**MPLNK.*DS1***	Set this parameter based on the network plan.
Bearing time slot	**MPLNK.*TSBITMAP***	Set this parameter based on the network plan.
Sub-protocol negotiate out time[S]	**MPLNK.*RESTARTTMR***	The default value is recommended.
Keep-alive timer length[S]	**MPLNK.*KEEPALIVE***	The default value is recommended.
CRC check mode	**MPLNK.*FCSTYPE***	The default value is recommended.

- MLPPP

  Before deploying MLPPP, add an MLPPP group and then add MLPPP links to the MLPPP group.

  The following table describes the key parameters that must be set in an **MPGRP** MO to add an MLPPP group. The subrack number, and slot number of the MLPPP group must be the same as those of the board where the group is located.

Parameter Name	Parameter ID	Setting Notes
MP type	**MPGRP.*MPTYPE***	Set this parameter to **MLPPP** at local and peer ends.
MP/MC list head option	**MPGRP.*MHF***	Set this parameter based on the network plan.
MC PRI number	**MPGRP.*MCCLASS***	This parameter is valid only if the **MPGRP.*MPTYPE*** parameter is set to **MLPPP**.
Head compress	**MPGRP.*IPHC***	Set this parameter to be consistent with the setting at the peer end.
Protocol field compress	**MPGRP.*PFC***	Set this parameter to be consistent with the setting at the peer end.
Address and Control Field Compress	**MPGRP.*ACFC***	Set this parameter to be consistent with the setting at the peer end.
PPP mux	**MPGRP.*PPPMUX***	Set this parameter to be consistent with the setting at the peer end.
PPP mux max sub-frame length	**MPGRP.*MAXSFLEN***	These parameters are valid only if the **MPGRP.*PPPMUX*** parameter is set to **ENABLE**. Set these

Parameter Name	Parameter ID	Setting Notes
PPP mux max mux-frame length	**MPGRP.*MAXMFLEN***	parameters based on the network plan.
PPP mux framing out-time[us]	**MPGRP.*MUXTIME***	

The following table describes the key parameters that must be set in an **MPLNK** MO to add an MLPPP link in an MLPPP group. The subrack number and slot number of the MLPPP group must be the same as those of the board where the link is located.

Parameter Name	Parameter ID	Setting Notes
MP Group No.	**MPLNK.*MPGRPN***	Each MLPPP group must have a unique group number.
PPP sub-link No.	**MPLNK.*PPPLNKN***	Each MLPPP link in an MLPPP group must have a unique link number.
E1T1 port No.	**MPLNK.*DS1***	Set this parameter based on the network plan.
Bearing time slot	**MPLNK.*TSBITMAP***	Set this parameter based on the network plan.
Sub-protocol negotiate out time[S]	**MPLNK.*RESTARTTMR***	The default value is recommended.
Keep-alive timer length[S]	**MPLNK.*KEEPALIVE***	The default value is recommended.
CRC check mode	**MPLNK.*FCSTYPE***	The default value is recommended.

6.4.2.2 Using MML Commands

Activation Command Examples

On the eNodeB/NodeB/eGBTS side:

- MC-PPP

```
ADD MPGRP: CN=0, SRN=0, SN=7, SBT=BASE_BOARD, MPGRPN=0, AUTH=NONAUTH,
LOCALIP="192.168.20.3", IPMASK="255.255.255.0", PEERIP="192.168.20.75",
MUXCP=ENABLE, IPHC=ENABLE, MCPPP=ENABLE, MHO=LONG, MCCLASS=8;
ADD MPLNK: CN=0, SRN=0, SN=7, SBT=BASE_BOARD, PPPLNKN=0, MPGRPN=0,
MPGRPSBT=BASE_BOARD, E1T1SRN=0, E1T1SN=7, E1T1SBT=BASE_BOARD, E1T1PN=0,
```



```
TSN=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&TS12-1
&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22-1&TS23-1&
TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1, PFC=DISABLE,
ACFC=DISABLE;
```

- MLPPP

```
ADD MPGRP: CN=0, SRN=0, SN=7, SBT=BASE_BOARD, MPGRPN=0, AUTH=NONAUTH,
LOCALIP="192.168.20.3", IPMASK="255.255.255.0", PEERIP="192.168.20.75",
MUXCP=ENABLE, IPHC=ENABLE, MCPPP=DISABLE;
ADD MPLNK: CN=0, SRN=0, SN=7, SBT=BASE_BOARD, PPPLNKN=0, MPGRPN=0,
MPGRPSBT=BASE_BOARD, E1T1SRN=0, E1T1SN=7, E1T1SBT=BASE_BOARD, E1T1PN=0,
TSN=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&TS12-1
&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22-1&TS23-1&
TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1, PFC=DISABLE,
ACFC=DISABLE;
```

On the GBTS side:

- MC-PPP

```
ADD BTSMPGRP: IDTYPE=BYID, BTSID=0, MPGRPN=0, CN=0, SRN=0, SN=7,
LOCALIP="192.168.20.3", MASK="255.255.255.0", PEERIP="192.168.20.75",
MPSWITCH=ENABLE, AUTHTYPE=NO_V, IPHC=ENABLE;
ADD BTSMPLNK: IDTYPE=BYID, BTSID=0, MPGRPN=0, PPPLNKN=0, PN=0, CN=0, SRN=0,
SN=7,
TSBITMAP=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&T
S12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22-1&TS
23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1;
```

- MLPPP

```
ADD BTSMPGRP: IDTYPE=BYID, BTSID=0, MPGRPN=0, CN=0, SRN=0, SN=7,
LOCALIP="192.168.20.3", MASK="255.255.255.0", PEERIP="192.168.20.75",
MPSWITCH=DISABLE, AUTHTYPE=NO_V, IPHC=ENABLE;
ADD BTSMPLNK: IDTYPE=BYID, BTSID=0, MPGRPN=0, PPPLNKN=0, PN=0, CN=0, SRN=0,
SN=7,
TSBITMAP=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&T
S12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22-1&TS
23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1;
```

On the base station controller side:

- MC-PPP

```
ADD MPGRP: SRN=0, SN=21, BRDTYPE=POUc, MPGRPN=0, MPTYPE=MCPPP,
BORROWDEVIP=NO, LOCALIP="192.168.20.75", MASK="255.255.255.0",
PEERIP="192.168.20.3", MHF=LONG, PPPMUX=Enable, FLOWCTRLSWITCH=ON,
AUTHTYPE=NO_V, ERRDETECTSW=OFF, ANTIERRFLAG=OFF, OPSEPFLAG=OFF;
ADD MPLNK: SRN=0, SN=21, BRDTYPE=POUc, MPGRPN=0, PPPLNKN=0, DS1=0,
TSBITMAP=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&T
S12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22-1&TS
23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1;
```

- MLPPP

```
ADD MPGRP: SRN=0, SN=21, BRDTYPE=POUc, MPGRPN=0, MPTYPE=MLPPP,
BORROWDEVIP=NO, LOCALIP="192.168.20.75", MASK="255.255.255.0",
PEERIP="192.168.20.3", PPPMUX=Enable, FLOWCTRLSWITCH=ON, AUTHTYPE=NO_V,
ERRDETECTSW=OFF, ANTIERRFLAG=OFF, OPSEPFLAG=OFF;
ADD MPLNK: SRN=0, SN=21, BRDTYPE=POUc, MPGRPN=0, PPPLNKN=0, DS1=0,
TSBITMAP=TS1-1&TS2-1&TS3-1&TS4-1&TS5-1&TS6-1&TS7-1&TS8-1&TS9-1&TS10-1&TS11-1&T
S12-1&TS13-1&TS14-1&TS15-1&TS16-1&TS17-1&TS18-1&TS19-1&TS20-1&TS21-1&TS22-1&TS
23-1&TS24-1&TS25-1&TS26-1&TS27-1&TS28-1&TS29-1&TS30-1&TS31-1;
```

6.4.2.3 Using the CME

This feature can be activated using the CME. This section uses the eNodeB as an example. For detailed operations, see CME-based Feature Configuration or the CME online help (click  on the wizard interface).

Configuration Type	CME Online Help
Single configuration	**CME Management** > **CME Guidelines** > **Getting Started with the CME** > **Introduction to Data Configuration Operations**
Batch eGBTS configuration	**CME Management** > **CME Guidelines** > **GSM Application Management** > **Base Station Related Operations** > **Importing and Exporting eGBTS Data for Batch Reconfiguration**
Batch NodeB configuration	**CME Management** > **CME Guidelines** > **UMTS Application Management** > **NodeB Related Operations** > **Importing and Exporting NodeB Data for Batch Configuration**
Batch eNodeB configuration	**CME Management** > **CME Guidelines** > **LTE Application Management** > **eNodeB Related Operations** > **Importing and Exporting eNodeB Data for Batch Configuration**

6.4.3 Activation Verification

eNodeB/NodeB/eGBTS

Run the **DSP BTSMPGRP** command, and then check the command output. If the value of **MLPPP Group Status** is **Up**, MLPPP/MC-PPP has been activated.

GBTS

Run the **DSP BTSMPGRP** command, and then check the command output. If the value of **MLPPP Group Status** is **Up**, MLPPP/MC-PPP has been activated.

On the Base Station Controller Side

Run the **DSP MPGRP** command, and then check the command output. If the value of **MLPPP Group Status** is **Up**, MLPPP/MC-PPP has been activated.

6.4.4 Network Monitoring

None

7 Parameters

The following hyperlinked EXCEL files of parameter reference match the software version with which this document is released.

- Node Parameter Reference: contains device and transport parameters.
- eNodeBFunction Parameter Reference: contains all parameters related to radio access functions, including air interface management, access control, mobility control, and radio resource management.

NOTE

You can find the EXCEL files of parameter reference for the software version on the live network from the product documentation delivered with that version.

FAQ: How do I find the parameters related to a certain feature from parameter reference?

Step 1 Open the EXCEL file of parameter reference.

Step 2 On the **Parameter List** sheet, filter the **Feature ID** column. Click **Text Filters** and choose **Contains**. Enter the feature ID, for example, LOFD-001016 or TDLOFD-001016.

Step 3 Click **OK**. All parameters related to the feature are displayed.

----End

8 Counters

The following hyperlinked EXCEL files of performance counter reference match the software version with which this document is released.

- Node Performance Counter Summary: contains device and transport counters.
- eNodeBFunction Performance Counter Summary: contains all counters related to radio access functions, including air interface management, access control, mobility control, and radio resource management.

NOTE

You can find the EXCEL files of performance counter reference for the software version used on the live network from the product documentation delivered with that version.

FAQ: How do I find the counters related to a certain feature from performance counter reference?

Step 1 Open the EXCEL file of performance counter reference.

Step 2 On the **Counter Summary(En)** sheet, filter the **Feature ID** column. Click **Text Filters** and choose **Contains**. Enter the feature ID, for example, LOFD-001016 or TDLOFD-001016.

Step 3 Click **OK**. All counters related to the feature are displayed.

----End

9 Glossary

For the acronyms, abbreviations, terms, and definitions, see *Glossary*.

10 Reference Documents

RFC 2686, " The Multi-Class Extension to Multi-Link PPP"

