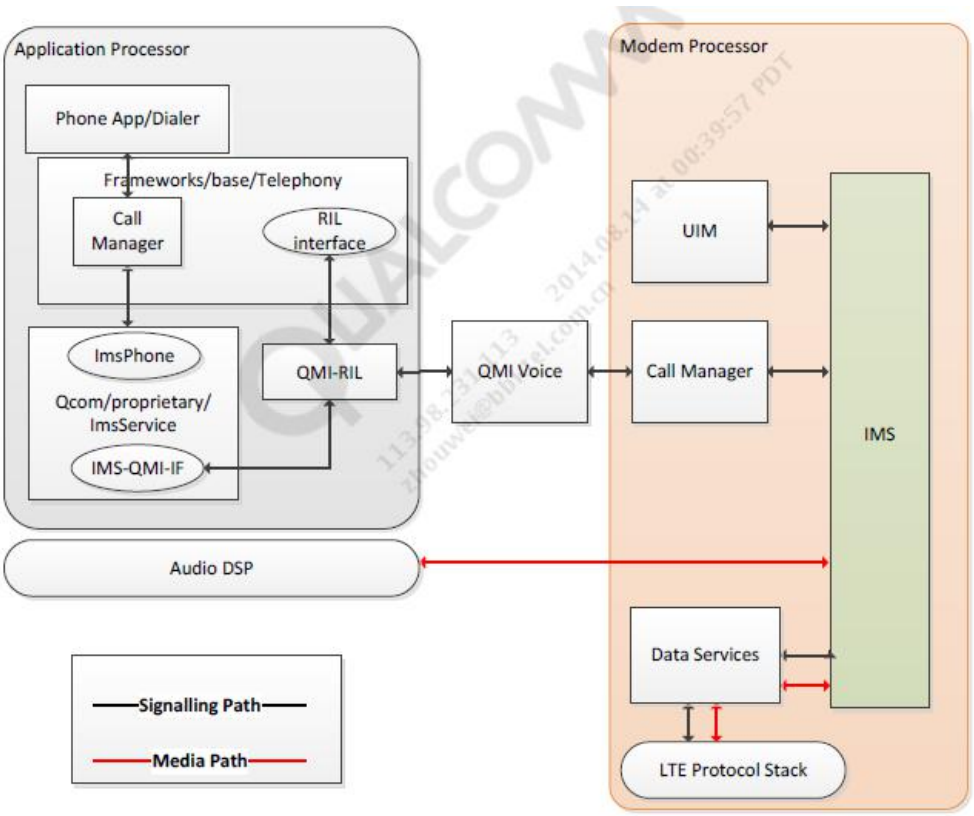
VoLTE Log 分析与主要 SIP 消息

高通在 IMS 产品介绍会上明确说明将 VoLTE 代码封装在 Modem 里，故 VoLTE 的 Log 主要是在 Modem 里；在 Main Log 和 Radio Log 里的信息量较少或压根没有输出；Net Log 里是 SIP 消息相关的，主要是看 SIP 消息的流程、配置有没有问题。



一、Log 分析

分析问题时，整体方向是：先用 Wireshark 看下有没有 SIP 消息，SIP 消息有没有异常，再看 Modem Log 里的空中接口相关的 Log，最后看详细的 Modem Log。

如果定位不到问题，或看 Modem Log 有困难，找网络适应性组的帮忙分析(早期是张平平在跟 VoLTE)，他们经验比较丰富，对空口消息比较熟悉，从 Modem 侧定位问题比较快速。如果网络适应性组的同事也定位不到问题，或忙不过来，需要提 Case 给高通，请高通的技术支持协助分析。

检查点：

1. NV 参数

NV 01896 ipv6_enabled 1 (1:开启 IPv6 地址类型)

NV 67261 IMSParamSrc 2 (2:从卡里读注册参数；0:从 NV 67258 读)

NV 67264 ---> RegPCOEnable/RegPreConfigEnabled

1) 注网时通过 PCO 发 P-CSCF 请求获取 P-CSCF 地址

RegPCOEnable = 1, RegPreConfigEnabled = 0

AT$QCPDPIMSCFGE=1,1,0,0 (Set PCO for profile 1)

2) 从 ISIM 卡读取 P-CSCF 域名

RegPCOEnable = 0, RegPreConfigEnabled = 1

Set *regManagerPreConfigServerBase to empty*

3) 从 NV 里读取 P-CSCF 地址

RegPCOEnable = 0, RegPreConfigEnabled = 1

Set *regManagerPreConfigServerBase = "P-CSCF IP address":SIP Port*

NV 71527 ---> iISIMPriority/iNVPriority/iPCOPriority

P-CSCF 地址获取方式的优先级，0 为禁用，值越小优先级越高(正数值)

A. P-CSCF from PCO and IMS parameters from Card: *ISIM=2, NV=3, PCO=1*

B. P-CSCF from NV and all others from Card: *ISIM=1, NV=2, PCO=0*

C. All IMS parameters from NV: *ISIM=0, NV=1, PCO=0*

2. SIM 卡

USIM/ISIM，只有这两种 SIM 卡可以注册 IMS，USIM 根据 IMSI 构造，ISIM 读卡里的 IMPI 和 IMPU。

IMS用户标识：每个用户分配1个私有用户标识（IMPI）和多个公有用户标识（IMPU）（IMPI:IM Private Identity,私有用户标识,IMPU:IM Public Identity,公有用户标识）。

IMPI用于注册、授权、管理、计费等目的。IMPU用于用户之间进行通讯，采用SIP URI格式或者TEL URI格式，包含1个E.164的TEL URI和2个SIP URI。其中TEL URI用户可见，用于业务发起与终结业务。SIP URI用户不可见，用于融合通信域

内的管理与路由。在融合通信系统中，一个用户的所有IMPU构成一个隐式注册集。

所有码号由网络配置，通过终端配置服务下发到终端。不允许用户申请自定义的SIP URI。

具体用户标识如下：

TEL URI：采用E.164编号，使用用户的手机号码，具体格式如：tel:+8613901011111

SIP URI：采用E.164编号+域名方式，具体格式如：sip：+8613901011111@<省份>.ims.mnc<mnc>.mcc<mcc>.3gppnetwork.org。

融合通信采用与VoLTE使用相同的IMPI和IMPU。

省公司 HSS 签约数据要求如表 8-1 所示。

表8-1用户IMS码号数据

存储位置	码号类别	码号格式
省 HSS	IMPI	<IMSI>@ims.mnc<mnc>.mcc<mcc>.3gppnetwork.org
	IMPU	IMPU1 sip:<IMSI>@ims.mnc<mnc>.mcc<mcc>.3gppnetwork.org IMPU2 sip: <MSISDN>@<省份>.ims.mnc<mnc>.mcc<mcc>.3gppnetwork.org IMPU3 tel：<MSISDN>

高通文档对 SIM 卡要求的描述如下：

The UICC card needs to have an ISIM application along with the proper credentials for IMS registration. The credentials include:

From the USIM

Mobile Subscriber Integrated Services Digital Network Number (MSISDN) - Generally the phone number of the device

From the ISIM

IMS Private Identity (IMPI)

IMS Public Identity (IMPU)

Domain - Domain of the home network

Security Key - Subscriber key for security authentication

OP - Operator algorithm configuration value

AuthScheme parameters - Algorithms for security authentication

3. 网络

要注册到支持 VoLTE 的 LTE 网络，并且数据网络开关要打开，Default APN 要设置好，Default APN 和 IMS APN 的 IP 地址类型要设置好（如：IPV4V6）。

有些卡虽然支持 IMS，但是可能会被 Modem 端的一些配置文件屏蔽掉（carrier_policy.xml），导致只能注册 GSM 网 -- 调试时碰到 PLMN 为 46005 的白卡被屏蔽的案例。

IMS 的注册和退注册，完全由 Modem 端控制，上层不可见。注册网络时，如果发起连接的 PDN 的 APN 类型里有 IMS（如 APN 类型配为：default,ia,ims），基站激活默认承载（手机上网用的那个 PDN），会下发 P-CSCF 的地址，手机随后向该地址发起 IMS 注册；

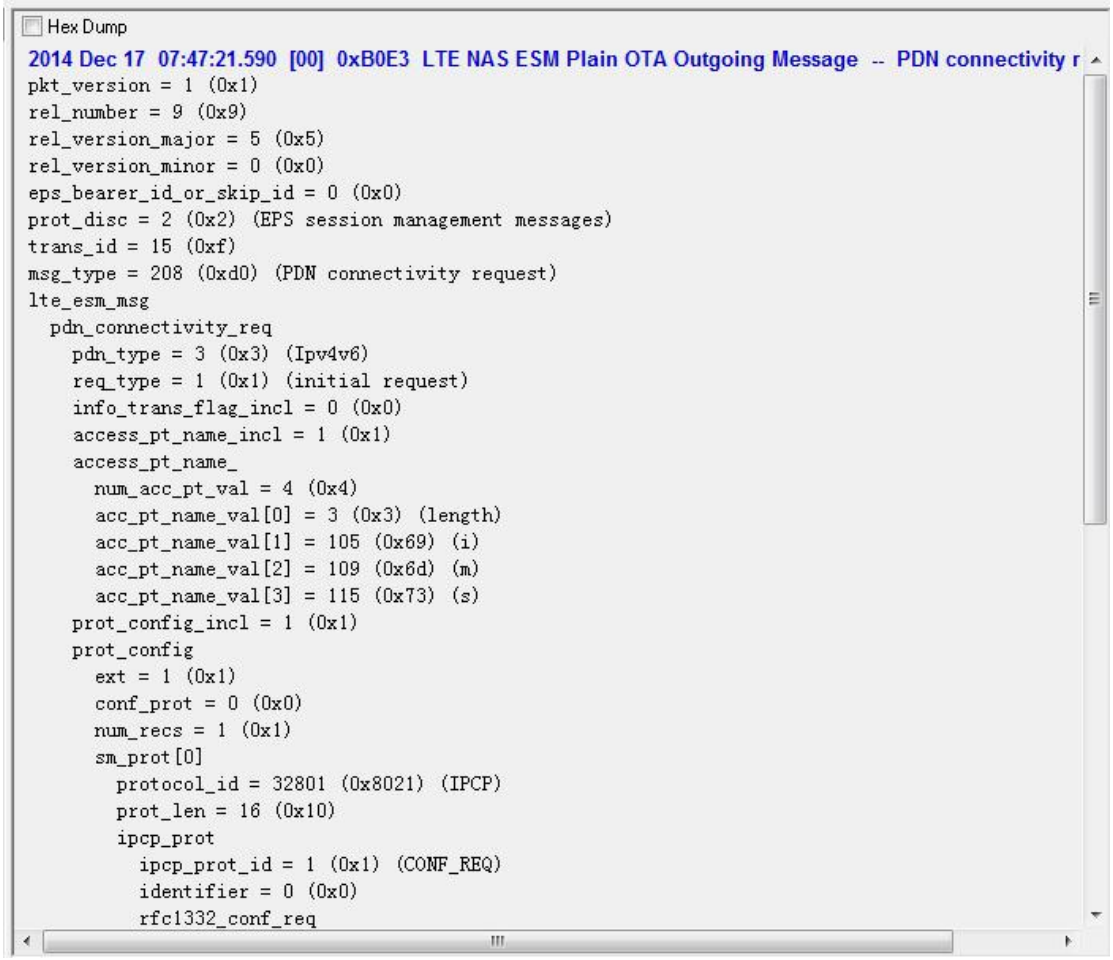
#	Time	Type	Description	Subtitle	Direction	S...	A
10884	2014 Dec ...	0xB0ED	LTE NAS EMM Plain OTA Outgoin...	Attach request Msg	BS <<< MS	121	
14275	2014 Dec ...	0xB0EC	LTE NAS EMM Plain OTA Incomin...	Authentication request Msg	BS >>> MS	52	
14445	2014 Dec ...	0xB0ED	LTE NAS EMM Plain OTA Outgoin...	Authentication response Msg	BS <<< MS	27	
14796	2014 Dec ...	0xB0EC	LTE NAS EMM Plain OTA Incomin...	Security mode command Msg	BS >>> MS	26	
14887	2014 Dec ...	0xB0ED	LTE NAS EMM Plain OTA Outgoin...	Security mode complete Msg	BS <<< MS	24	
16270	2014 Dec ...	0xB0E2	LTE NAS ESM Plain OTA Incoming...	ESM information request Msg	BS >>> MS	19	
16288	2014 Dec ...	0xB0E3	LTE NAS ESM Plain OTA Outgoing...	ESM information response Msg	BS <<< MS	32	
17834	2014 Dec ...	0xB0EC	LTE NAS EMM Plain OTA Incomin...	Attach accept Msg	BS >>> MS	166	
17838	2014 Dec ...	0xB0E2	LTE NAS ESM Plain OTA Incoming...	Activate default EPS bearer context request Msg	BS >>> MS	153	
18869	2014 Dec ...	0xB0ED	LTE NAS EMM Plain OTA Outgoin...	Attach complete Msg	BS <<< MS	29	
25129	2014 Dec ...	0xB0E2	LTE NAS ESM Plain OTA Incoming...	Activate default EPS bearer context request Msg	BS >>> MS	115	
25381	2014 Dec ...	0xB0E3	LTE NAS ESM Plain OTA Outgoing...	Activate default EPS bearer context accept Msg	BS <<< MS	25	

Hex Dump

```
prot_config
  ext = 1 (0x1)
  conf_prot = 0 (0x0)
  num_recs = 0 (0x0)
  num_recs2 = 4 (0x4)
  sm_container[0]
    container_id = 13 (0xd) (DNS Server IPv4 Address)
    container_len = 4 (0x4)
    container_contents[0] = 192 (0xc0)
    container_contents[1] = 168 (0xa8)
    container_contents[2] = 0 (0x0)
    container_contents[3] = 1 (0x1)
  sm_container[1]
    container_id = 3 (0x3) (DNS Server IPv6 Address)
    container_len = 16 (0x10)
    address = 0x30000000000000002000000000000001 (3000:0:0:2:0:0:0:1)
  sm_container[2]
    container_id = 1 (0x1) (P-CSCF IPV6 Address)
    container_len = 16 (0x10)
    address = 0xfd29cc437fb90002020c29fffe66b4c7 (fd29:cc43:7fb9:2:20c:29ff:fe66:b4c7)
  sm_container[3]
    container_id = 12 (0xc) (P-CSCF IPv4 Address)
    container_len = 4 (0x4)
    container_contents[0] = 192 (0xc0)
    container_contents[1] = 168 (0xa8)
    container_contents[2] = 198 (0xc6)
    container_contents[3] = 55 (0x37)
connectivity_type_incl = 0 (0x0)
```

如果手机在默认承载里没有 P-CSCF 地址，手机会发起 IMS 的 PDN 请求；

#	Time	Type	Description	Subtitle	Direction
10456	2014 Dec ...	0xB0ED	LTE NAS EMM Plain OTA Outgoin...	Attach request Msg	BS <<< MS
12969	2014 Dec ...	0xB0EC	LTE NAS EMM Plain OTA Incomin...	Authentication request Msg	BS >>> MS
13212	2014 Dec ...	0xB0ED	LTE NAS EMM Plain OTA Outgoin...	Authentication response Msg	BS <<< MS
13403	2014 Dec ...	0xB0EC	LTE NAS EMM Plain OTA Incomin...	Security mode command Msg	BS >>> MS
13507	2014 Dec ...	0xB0ED	LTE NAS EMM Plain OTA Outgoin...	Security mode complete Msg	BS <<< MS
14061	2014 Dec ...	0xB0E2	LTE NAS ESM Plain OTA Incoming...	ESM information request Msg	BS >>> MS
14083	2014 Dec ...	0xB0E3	LTE NAS ESM Plain OTA Outgoing...	ESM information response Msg	BS <<< MS
14383	2014 Dec ...	0xB0EC	LTE NAS EMM Plain OTA Incomin...	Identity request Msg	BS >>> MS
14401	2014 Dec ...	0xB0ED	LTE NAS EMM Plain OTA Outgoin...	Identity response Msg	BS <<< MS
16318	2014 Dec ...	0xB0EC	LTE NAS EMM Plain OTA Incomin...	Attach accept Msg	BS >>> MS
16449	2014 Dec ...	0xB0E2	LTE NAS ESM Plain OTA Incoming...	Activate default EPS bearer context request Msg	BS >>> MS
17395	2014 Dec ...	0xB0ED	LTE NAS EMM Plain OTA Outgoin...	Attach complete Msg	BS <<< MS
23281	2014 Dec ...	0xB0E3	LTE NAS ESM Plain OTA Outgoing...	PDN connectivity request Msg	BS <<< MS
23759	2014 Dec ...	0xB0EC	LTE NAS EMM Plain OTA Incomin...	EMM information Msg	BS >>> MS
29919	2014 Dec ...	0xB0E2	LTE NAS ESM Plain OTA Incoming...	Activate default EPS bearer context request Msg	BS >>> MS
30101	2014 Dec ...	0xB0E3	LTE NAS ESM Plain OTA Outgoing...	Activate default EPS bearer context accept Msg	BS <<< MS



如果在 Default PDN 和 IMS PDN 两个承载里都没有发现 P-CSCF 地址，则不会发起 IMS 注册。

高通文档描述：

When the UE powers up, it will initially attach to the IMS PDN, then the IMS app on the modem side will automatically connect to the IMS PDN for IMS registration. As soon as attach is complete, Android will use the default profile to trigger an additional PDN connect to the internet PDN.

We usually create two Profiles for the VoLTE by QMICM, the first one is for the Internet APN and the second is for the IMS APN. The MTP will attach to the Internet APN and then initiate the PDN Connect request to the IMS APN. After the successfully IMS APN connection and QCI = 5 bear activation, the MTP will be able to send IMS SIP Register Message to the P-CSCF.

4. 通路检查

SIM 卡，射频功率，和 Modem 侧检查

Contents：

Camping Issues

SIB Decode Failure

RACH Failures

Radio Link Failures

Low DL Throughput Issues

Low UL Throughput Issues

Data Sanity for Throughput Issues

F3 Keywords

《80-NE962-1_A_LTE_AS_Typical_Field_Scenarios_Checklists.pdf》

二、SIP 消息：

会话初始化协议 SIP(Session Initiation Protocol)是一个在 IP 网络上进行多媒体通信的应用层控制协议,它被用来创建,修改,和终结一个或多个参加者参加的会话进程。

SIP Body 里的 SDP(会话描述)部分，请阅读 SDP 协议。

SIP 的请求方法：INVITE，ACK，BYE，CANCEL，OPTIONS，REGISTER，PRACK，SUBSCRIBE，NOTIFY，PUBLISH，INFO，REFER，MESSAGE，UPDATE。详细内容请阅读 SIP 协议。

中移动在 IMS 用的 SIP，有部分扩展，详细内容请阅读《中国移动 CM-IMS(SIP)技术规范》的第 2 部分《中国移动 CM-IMS(SIP)技术规范_第 2 部分：SIP 的消息 V1.0.0.doc》，该文档描述了 CM-IMS 所用的 SIP 的格式，**信息头名称简写也可以查到**。

详细的 SIP 消息流程，请阅读《中国移动 CM-IMS(SIP)技术规范》的第 3 部分《中国移动 CM-IMS(SIP)技术规范_第 3 部分：SIP 的基本流程.doc》。

中移动对 SIP 消息、头域以及信令流程提出的定制化需求，请阅读《中国移动 CM-IMS(SIP)技术规范》的第 4 部分《中国移动 CM-IMS(SIP)技术规范_第 4 部分：CM-IMS 业务对 SIP 的要求 V1.0.0.doc》。

这里只列出 IMS 注册、主叫、被叫、eSRVCC、PS 上收发 SMS，退注册的 SIP 消息和空中接口消息，其他的 SIP 消息请阅读《41-融合通信接口规范（终端-平

台接口分册）v1.0.0（技术参考版）.pdf》、《41-融合通信接口规范（终端-平台接口分册）v1.0.0（技术参考版）20140716.docx》(两个文档内容一样，word 格式易于搜索)，其他的空中接口消息请阅读《VoLTE 终端测试规范——通信功能和性能分册 V1.0.0（报批稿）.pdf》。

1. IMS 注册

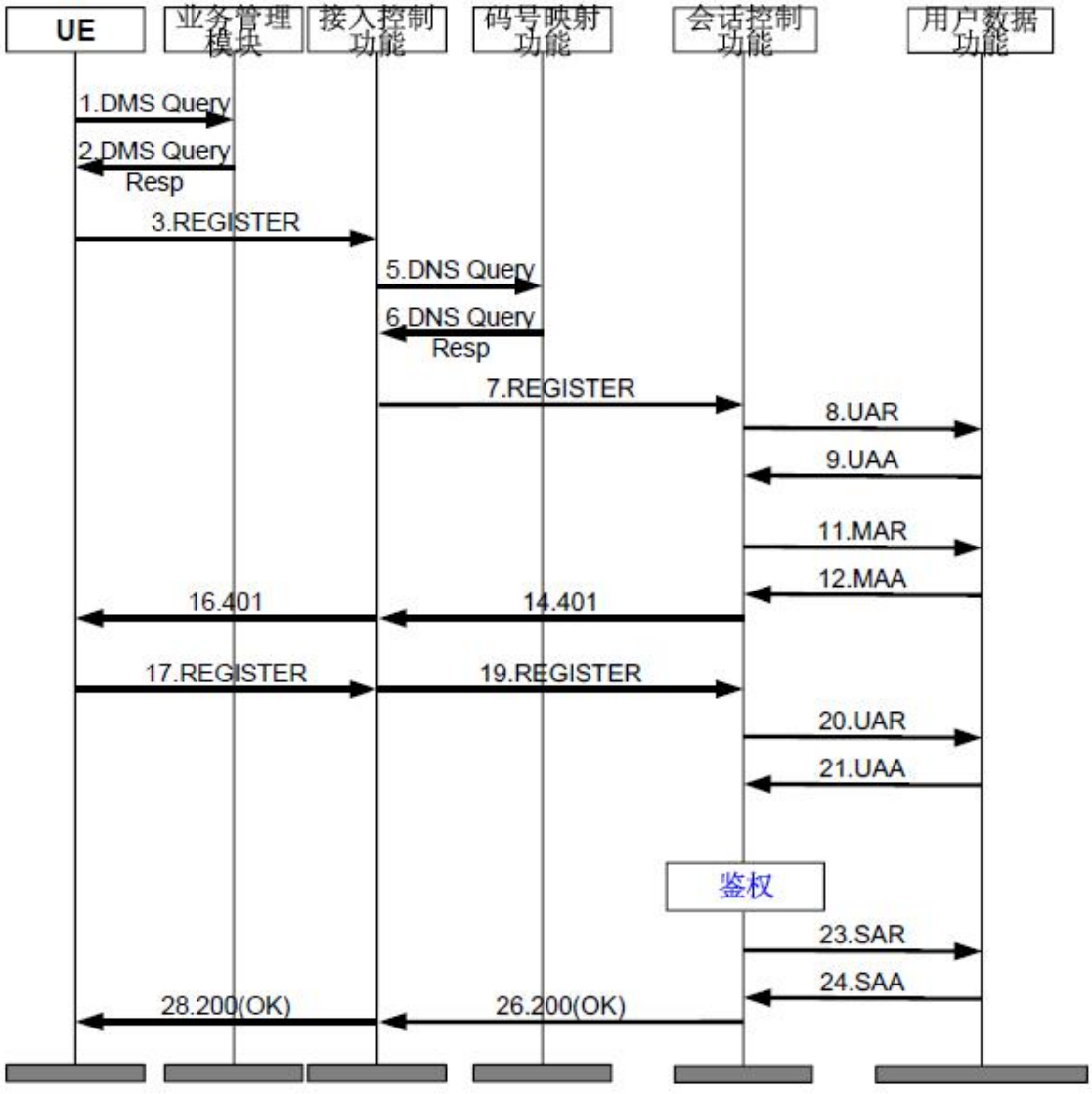


图 5-7　注册流程

SIP 消息：

Request: REGISTER sip:ims.mnc001.mcc001.3gppnetwork.org (1 binding)

Status: 401 Unauthorized

Request: REGISTER sip:ims.mnc001.mcc001.3gppnetwork.org (1 binding)

Status: 200 OK (1 binding)

说明：

[MS --> NW] 手机向网络(PLMN 为 00101)请求 IMS 注册

[NW --> MS] 网络回复 401 Unauthorized，消息里携带鉴权需要用到的信息

[MS --> NW] 手机再次请求 IMS 注册，消息里携带鉴权应答信息

[NW --> MS] 网络回复 200 OK，消息里携带 VoLTE 能力信息

空口消息如下：

UL	RRC CONNECTION REQUEST	//RRC 请求
UL	RRC CONNECTION SETUP COMPLETE	//RRC 请求建立
DL	EMM: AUTHENTICATION REQUEST	//鉴权请求
UL	EMM: AUTHENTICATION RESPONSE	//鉴权应答
DL	EMM: SECURITY MODE COMMAND	//安全模式命令(信令完整性保护)
UL	EMM: SECURITY MODE COMPLETE	//安全模式完成
DL	SECURITY MODE COMMAND	
UL	SECURITY MODE COMPLETE	
DL	ESM: ESM INFORMATION REQUEST	//ESM 信息请求
UL	ESM: ESM INFORMATION RESPONSE	//ESM 信息应答
DL	EMM: IDENTITY REQUEST	//身份请求(IMSI)
UL	EMM: IDENTITY RESPONSE	//身份应答
DL	UE CAPABILITY ENQUIRY	//UE 能力查询
UL	UE CAPABILITY INFORMATION	//UE 能力应答
DL	RRC CONNECTION RECONFIGURATION	//RRC 连接重配
UL	RRC CONNECTION RECONFIGURATION COMPLETE	//RRC 连接重配完成
UL	EMM: ATTACH COMPLETE / ESM: ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT	
DL	EMM: EMM INFORMATION	
UL	ESM: PDN CONNECTIVITY REQUEST	//PDN 连接请求
DL	RRC CONNECTION RECONFIGURATION	//RRC 连接重配
UL	RRC CONNECTION RECONFIGURATION COMPLETE	//RRC 连接重配完成
UL	ESM: ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT	//默认承载建立

具体的 SIP 消息：

REGISTER sip:ims.mnc001.mcc001.3gppnetwork.org SIP/2.0

f: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=559862614

t: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>

CSeq: 559862607 REGISTER

i: 559862608_185027992@192.168.1.1

v: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK1775912190
Max-Forwards: 70
m: <sip:001010123456789@192.168.1.1:5060>;+sip.instance="<urn:gsma:imei:86540701-000000-0>";+g.3gpp.icsi-ref="urn%3Aurn-7%3A3gpp-service.ims.icsi.mmtel";+g.3gpp.smsip;audio;video
Route: <sip:192.168.1.2:5060;lr>
P-Access-Network-Info: 3GPP-E-UTRAN-TDD; utran-cell-id-3gpp=0010100010000000
l: 0
Authorization: Digest uri="sip:ims.mnc001.mcc001.3gppnetwork.org",username="001010123456789@ims.mnc001.mcc001.3gppnetwork.org",response="",realm="ims.mnc001.mcc001.3gppnetwork.org",nonce=""
Expires: 7200
k: path
Allow: INVITE,BYE,CANCEL,ACK,NOTIFY,UPDATE,REFER,PRACK,INFO,MESSAGE,OPTIONS

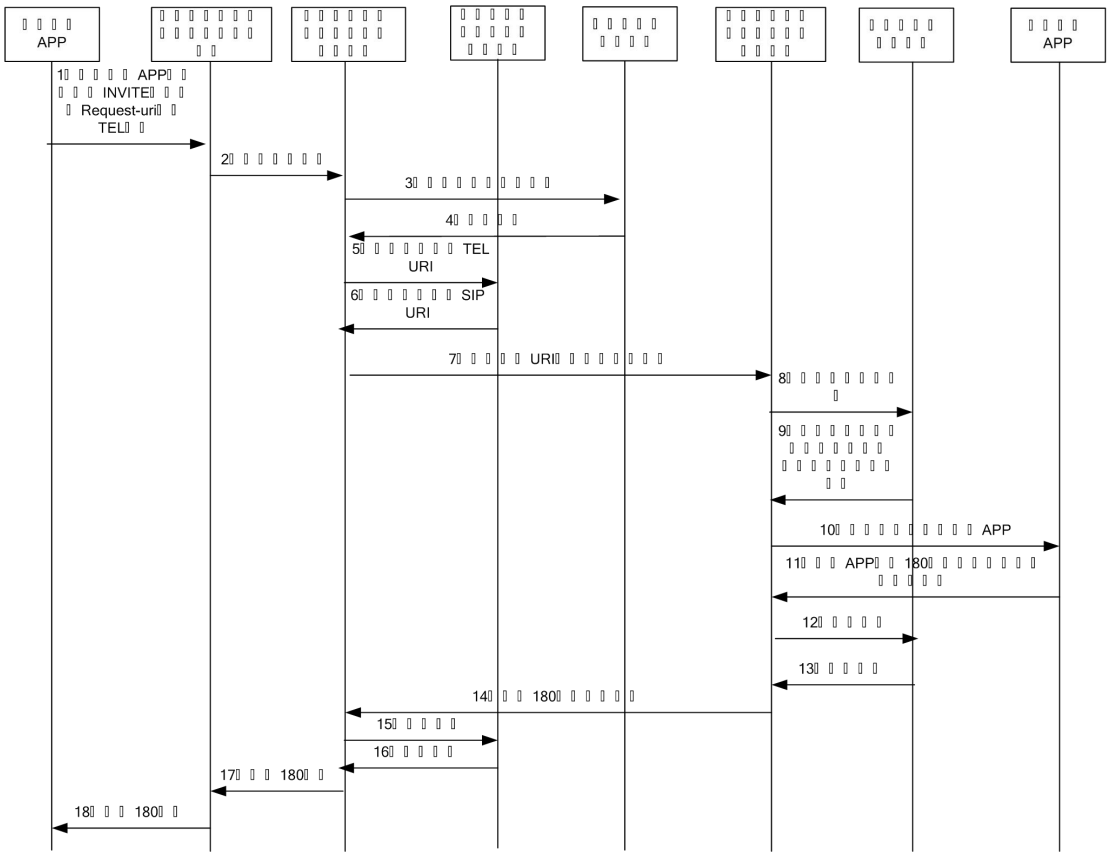
SIP/2.0 401 Unauthorized
Max-Forwards: 70
Via: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK1775912190
From: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=559862614
To: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=987654321
Call-ID: 559862608_185027992@192.168.1.1
CSeq: 559862607 REGISTER
Allow: INVITE, ACK, CANCEL, BYE, PRACK, MESSAGE
WWW-Authenticate: digest realm="ims.mnc001.mcc001.3gppnetwork.org",nonce="oM42/i7uOko6JtopNRZQTM1qu1w9soAAoN8UzWq73D0=",qop="auth",opaque="3c6d55553a25424297fe4c604283c04d",algorithm=AKAv1-MD5
Content-Length: 0

REGISTER sip:ims.mnc001.mcc001.3gppnetwork.org SIP/2.0
f: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=559862948
t: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>
CSeq: 559862608 REGISTER
i: 559862608_185027992@192.168.1.1
v: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK3758589676
Max-Forwards: 70
m: <sip:001010123456789@192.168.1.1:5060>;+g.3gpp.icsi-ref="urn%3Aurn-7%3A3gpp-service.ims.icsi.mmtel";+g.3gpp.smsip;audio;video;+sip.instance="<urn:gsma:imei:86540701-000000-0>"
Route: <sip:192.168.1.2:5060;lr>
P-Access-Network-Info: 3GPP-E-UTRAN-TDD; utran-cell-id-3gpp=0010100010000000
l: 0
Authorization: Digest username="001010123456789@ims.mnc001.mcc001.3gppnetwork.org",realm="ims.mnc001.mcc001.3gppnetwork.org",uri="sip:ims.mnc001.mcc001.3gppnetwork.org",qop=auth,nonce="oM42/i7uOko6JtopNRZQTM1qu1w9soAAoN8UzWq73D0=",nc=00000001,cnonc

e="559862599",algorithm=AKAv1-MD5,response="e2b7ccc174945b193ea9c8529a2c28f0",opaque="3c6d55553a25424297fe4c604283c04d"
Expires: 7200
k: path
Allow: INVITE,BYE,CANCEL,ACK,NOTIFY,UPDATE,REFER,PRACK,INFO,MESSAGE,OPTIONS

SIP/2.0 200 OK
Max-Forwards: 70
Via: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK3758589676
From: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=559862948
To: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=559862948
Call-ID: 559862608_185027992@192.168.1.1
CSeq: 559862608 REGISTER
Allow: INVITE, ACK, CANCEL, BYE, PRACK, MESSAGE
Date: Sat, 15 Nov 2014 16:24:51 GMT
P-Associated-URI: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>
Contact: <sip:001010123456789@192.168.1.1:5060>;+g.3gpp.icsi-ref="urn%3Aurn-7%3A3gpp-service.ims.icsi.mmtel";+g.3gpp.smsip;audio;video;+sip.instance="<urn:gsma:imei:86540701-000000-0>";expires=7200
Content-Length: 0

2. 主叫流程



SIP 消息：

Request: INVITE sip:0123456789;phone-context=ims.gd.chinamobile.com@ims.gd.chinamobile.com;user=phone

Status: 100 Trying

Status: 180 Ringing

Request: PRACK sip:0123456789@192.168.1.2:55379;transport=udp

Status: 200 OK

Status: 200 OK

Request: ACK sip:0123456789@192.168.1.2:55379;transport=udp

Request: BYE sip:0123456789@192.168.1.2:55379;transport=udp

Status: 200 OK

说明：

[MS --> NW] 手机语音呼叫用户 0123456789

[NW --> MS] 网络回复 100 Trying，开始寻呼

[NW --> MS] 网络回复 180 Ringing，找到被叫，响铃振铃

[MS --> NW] 手机用 PRACK 回复 100rel，通知网络已收到振铃消息

[NW --> MS] 网络回复 200 OK (PRACK)

[NW --> MS] 网络回复 200 OK (INVITE)，被叫应答

[MS --> NW] 主叫回复 ACK，呼叫建立

…… …… 通话中 …… ……

[MS --> NW] 主叫发 BYE 挂机

[NW --> MS] 网络回复 200 OK，挂断电话

空口消息如下：

DL RRC CONNECTION RECONFIGURATION
UL RRC CONNECTION RECONFIGURATION COMPLETE
UL ESM: ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT //专用承载建立
DL RRC CONNECTION RECONFIGURATION
UL RRC CONNECTION RECONFIGURATION COMPLETE
UL ESM: DEACTIVATE EPS BEARER CONTEXT ACCEPT //恢复默认承载

具体的 SIP 消息：

INVITE sip:0123456789;phone-context=ims.gd.chinamobile.com@ims.gd.chinamobile.com;user=phone SIP/2.0
f: "18406630020" <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=561128308
t: <sip:0123456789;phone-context=ims.gd.chinamobile.com@ims.gd.chinamobile.com;user=phone>
CSeq: 561128295 INVITE
i: 561128295_185090136@192.168.1.1
v: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK3624637363
Max-Forwards: 70
m: <sip:001010123456789@192.168.1.1:5060>;+g.3gpp.icsi-ref="urn%3Aurn-7%3A3gpp-service.ims.icsi.mmtel";audio;video
Route: <sip:192.168.1.2:5060;lr>
P-Access-Network-Info: 3GPP-E-UTRAN-TDD; utran-cell-id-3gpp=0010100010000000
P-Preferred-Identity: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>
Allow: INVITE,ACK,CANCEL,BYE,UPDATE,PRACK,MESSAGE,REFER,NOTIFY,INFO
c: application/sdp
Accept: application/sdp,application/3gpp-ims+xml

P-Preferred-Service: urn:urn-7:3gpp-service.ims.icsi.mmtel
a: *;+g.3gpp.icsi-ref="urn%3Aurn-7%3A3gpp-service.ims.icsi.mmtel";audio
k: 100rel,replaces,from-change
P-Early-Media: supported
l: 435

v=0
o=root 5000 1000 IN IP4 192.168.1.1
s=QC VOIP
c=IN IP4 192.168.1.1
t=0 0
m=audio 50010 RTP/AVP 104 102 105 100
b=AS:41
b=RS:0
b=RR:0
a=rtpmap:104 AMR-WB/16000
a=fmtp:104 mode-change-capability=2;max-red=0
a=rtpmap:102 AMR/8000
a=fmtp:102 mode-change-capability=2;max-red=0
a=rtpmap:105 telephone-event/16000
a=fmtp:105 0-15
a=rtpmap:100 telephone-event/8000
a=fmtp:100 0-15
a=sendrecv
a=maxptime:240
a=ptime:20

SIP/2.0 100 Trying
Via: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK3624637363
Max-Forwards: 70
From: "18406630020" <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=561128308
To: <sip:0123456789@ims.gd.chinamobile.com;phone-context=ims.gd.chinamobile.com;user=phone>
Call-ID: 561128295_185090136@192.168.1.1
CSeq: 561128295 INVITE
Content-Length: 0

SIP/2.0 180 Ringing
Max-Forwards: 70
Via: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK3624637363
From: "18406630020" <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=561128308

To: <sip:0123456789@ims.gd.chinamobile.com;phone-context=ims.gd.chinamobile.com;user=phone>;tag=1111111111
Call-ID: 561128295_185090136@192.168.1.1
CSeq: 561128295 INVITE
Allow: INVITE, ACK, CANCEL, BYE, PRACK, UPDATE
Record-Route: <sip:192.168.1.2:5060;lr>
Require: 100rel
Supported: precondition
Supported: 100rel
RSeq: 1
Privacy: none
User-Agent: Anritsu-VirtualUA/4596
Content-Length: 0
Contact: <sip:0123456789@192.168.1.2:55379;transport=udp>
P-Asserted-Identity: <sip:0123456789@ims.gd.chinamobile.com;phone-context=ims.gd.chinamobile.com;user=phone>

PRACK sip:0123456789@192.168.1.2:55379;transport=udp SIP/2.0
Max-Forwards: 70
From: "18406630020" <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=561128308
To: <sip:0123456789@ims.gd.chinamobile.com;phone-context=ims.gd.chinamobile.com;user=phone>;tag=1111111111
Call-ID: 561128295_185090136@192.168.1.1
CSeq: 561128296 PRACK
User-Agent: Anritsu-VirtualUA/4596
Content-Length: 0
v: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK4129161699
P-Access-Network-Info: 3GPP-E-UTRAN-TDD; utran-cell-id-3gpp=0010100010000000
RAck: 1 561128295 INVITE
Route: <sip:192.168.1.2:5060;lr>

SIP/2.0 200 OK
Max-Forwards: 70
Via: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK4129161699
From: "18406630020" <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=561128308
To: <sip:0123456789@ims.gd.chinamobile.com;phone-context=ims.gd.chinamobile.com;user=phone>;tag=1111111111
Call-ID: 561128295_185090136@192.168.1.1
CSeq: 561128296 PRACK
Allow: INVITE, ACK, CANCEL, BYE, PRACK, UPDATE
Record-Route: <sip:192.168.1.2:5060;lr>

Supported: 100rel
User-Agent: Anritsu-VirtualUA/4596
Content-Length: 0
Contact: <sip:0123456789@192.168.1.2:55379;transport=udp>

SIP/2.0 200 OK
Max-Forwards: 70
Via: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK3624637363
From: "18406630020" <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=561128308
To: <sip:0123456789@ims.gd.chinamobile.com;phone-context=ims.gd.chinamobile.com;user=phone>;tag=1111111111
Call-ID: 561128295_185090136@192.168.1.1
CSeq: 561128295 INVITE
Allow: INVITE, ACK, CANCEL, BYE, PRACK, UPDATE
Record-Route: <sip:192.168.1.2:5060;lr>
User-Agent: Anritsu-VirtualUA/4596
Content-Type: application/sdp
Content-Length: 465
Contact: <sip:0123456789@192.168.1.2:55379;transport=udp>

v=0
o=anritsu 853 671855 IN IP4 192.168.1.2
s=-
i=A VOIP Session
c=IN IP4 192.168.1.2
t=0 0
m=audio 60000 RTP/AVP 104 102 105 100
b=AS:41
b=RS:0
b=RR:0
a=rtpmap:104 AMR-WB/16000
a=fmtp:104 mode-change-capability=2;max-red=0
a=rtpmap:102 AMR/8000
a=fmtp:102 mode-change-capability=2;max-red=0
a=rtpmap:105 telephone-event/16000
a=fmtp:105 0-15
a=rtpmap:100 telephone-event/8000
a=fmtp:100 0-15
a=sendrecv
a=maxptime:240
a=ptime:20
a=rtcp:60001

ACK sip:0123456789@192.168.1.2:55379;transport=udp SIP/2.0
Max-Forwards: 70
Via: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK901577778
From: "18406630020" <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=561128308
To: <sip:0123456789@ims.gd.chinamobile.com;phone-context=ims.gd.chinamobile.com;user=phone>;tag=1111111111
Call-ID: 561128295_185090136@192.168.1.1
CSeq: 561128295 ACK
Content-Length: 0
Route: <sip:192.168.1.2:5060;lr>

BYE sip:0123456789@192.168.1.2:55379;transport=udp SIP/2.0
t: <sip:0123456789@ims.gd.chinamobile.com;phone-context=ims.gd.chinamobile.com;user=phone>;tag=1111111111
f: "18406630020" <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=561128308
i: 561128295_185090136@192.168.1.1
CSeq: 561128297 BYE
v: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK3262761237
Max-Forwards: 70
P-Access-Network-Info: 3GPP-E-UTRAN-TDD; utran-cell-id-3gpp=0010100010000000
l: 0
Route: <sip:192.168.1.2:5060;lr>
P-Preferred-Identity: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>

SIP/2.0 200 OK
Max-Forwards: 70
Via: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK3262761237
From: "18406630020" <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=561128308
To: <sip:0123456789@ims.gd.chinamobile.com;phone-context=ims.gd.chinamobile.com;user=phone>;tag=1111111111
Call-ID: 561128295_185090136@192.168.1.1
CSeq: 561128297 BYE
Allow: INVITE, ACK, CANCEL, BYE, PRACK, UPDATE
Record-Route: <sip:192.168.1.2:5060;lr>
Privacy: none
User-Agent: Anritsu-VirtualUA/4596
Content-Length: 0
Contact: <sip:0123456789@192.168.1.2:55379;transport=udp>
P-Asserted-Identity: <sip:0123456789@ims.gd.chinamobile.com;phone-context=ims.gd.chinamobile.com;user=phone>

3. 被叫流程

SIP 消息：

Request:INVITE sip:001010123456789@192.168.1.1:5060

Status:100 Trying

Status:SIP/2.0 180 Ringing

Status:SIP/2.0 200 OK

Request: BYE sip:001010123456789@192.168.1.1:5060

Status: SIP/2.0 200 OK

说明：

[NW --> MS] 网络寻呼 sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org

[MS --> NW] 手机回复 100 Trying

[MS --> NW] 手机回复 180 Ringing，振铃

[MS --> NW] 手机回复 200 OK，应答，被叫建立

……. ……. 通话中 ……. …….

[NW --> MS] 网络发 BYE 挂机

[MS --> NW] 手机回复 200 OK，挂断电话

空口消息如下：

DL RRC CONNECTION RECONFIGURATION
UL RRC CONNECTION RECONFIGURATION COMPLETE
UL ESM: ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT //专用承载建立
DL RRC CONNECTION RECONFIGURATION
UL RRC CONNECTION RECONFIGURATION COMPLETE
UL ESM: DEACTIVATE EPS BEARER CONTEXT ACCEPT //恢复默认承载

具体的 SIP 消息：

INVITE sip:001010123456789@192.168.1.1:5060 SIP/2.0
Via: SIP/2.0/UDP 192.168.1.2:60124;branch=z9hG4bKe9f77cafd88b452dab9752198ad5e94f28;rport;transport=udp

Via: SIP/2.0/UDP 192.168.1.2:60115;branch=z9hG4bKf3b6a856a57d467e9437f54d214995ea21dbba51
Max-Forwards: 69
Call-ID: c64488da3d6644409c0b6324e3cd911c
CSeq: 9001 INVITE
To: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>
From: <sip:0123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=1111111111
Allow: INVITE, PRACK, UPDATE, ACK, BYE, CANCEL
Supported: 100rel
Supported: precondition
Accept-Contact: *;+g.3gpp.icsi-ref="urn%3Aurn-7%3A3gpp-service.ims.icsi.mmtel";require;explicit
User-Agent: Anritsu-VirtualUA/4596
Content-Type: application/sdp
Content-Length: 569
Contact: <sip:0123456789@192.168.1.2:60115;transport=udp>
Privacy: none
P-Asserted-Identity: <sip:0123456789@ims.mnc001.mcc001.3gppnetwork.org>
Record-Route: <sip:192.168.1.2;lr>

v=0
o=anritsu 9 457009 IN IP4 192.168.1.2
s=-
i=A VOIP Session
c=IN IP4 192.168.1.2
t=0 0
m=audio 60000 RTP/AVP 107 97 8 0 101
b=AS:64
b=RS:800
b=RR:2400
a=ptime:20
a=maxptime:20
a=rtpmap:107 AMR-WB/16000
a=fmtp:107 octet-align=1; mode-set=2
a=rtpmap:97 AMR/8000
a=fmtp:97 octet-align=1; mode-set=7
a=rtpmap:8 PCMA/8000/1
a=rtpmap:0 PCMU/8000/1
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
a=mid:0
a=sendrecv
a=rtcp:60001

a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos optiSIP/2.0 100 Trying
Via: SIP/2.0/UDP 192.168.1.2:60124;branch=z9hG4bKe9f77cafd88b452dab9752198ad5e94f28;rport;transport=udp,SIP/2.0/UDP 192.168.1.2:60115;branch=z9hG4bKf3b6a856a57d467e9437f54d214995ea21dbba51
Call-ID: c64488da3d6644409c0b6324e3cd911c
CSeq: 9001 INVITE
To: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>
From: <sip:0123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=1111111111
Content-Length: 0

SIP/2.0 180 Ringing
Via: SIP/2.0/UDP 192.168.1.2:60124;branch=z9hG4bKe9f77cafd88b452dab9752198ad5e94f28;rport;transport=udp,SIP/2.0/UDP 192.168.1.2:60115;branch=z9hG4bKf3b6a856a57d467e9437f54d214995ea21dbba51
Call-ID: c64488da3d6644409c0b6324e3cd911c
CSeq: 9001 INVITE
To: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=733280944
From: <sip:0123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=1111111111
Content-Length: 0
Contact: <sip:001010123456789@192.168.1.1:5060>;+g.3gpp.icsi-ref="urn%3Aurn-7%3A3gpp-service.ims.icsi.mmtel";audio;video
Record-Route: <sip:192.168.1.2;lr>
P-Access-Network-Info: 3GPP-E-UTRAN-TDD; utran-cell-id-3gpp=0010100010000000
Allow: INVITE,ACK,CANCEL,BYE,UPDATE,PRACK,MESSAGE,REFER,NOTIFY,INFO

SIP/2.0 200 OK
Via: SIP/2.0/UDP 192.168.1.2:60124;branch=z9hG4bKe9f77cafd88b452dab9752198ad5e94f28;rport;transport=udp,SIP/2.0/UDP 192.168.1.2:60115;branch=z9hG4bKf3b6a856a57d467e9437f54d214995ea21dbba51
Call-ID: c64488da3d6644409c0b6324e3cd911c
CSeq: 9001 INVITE
To: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=733280944
From: <sip:0123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=1111111111
Content-Type: application/sdp
Content-Length: 328
Contact: <sip:001010123456789@192.168.1.1:5060>;+g.3gpp.icsi-ref="urn%3Aurn-7%3A3gpp-service.ims.icsi.mmtel";audio;video
Record-Route: <sip:192.168.1.2;lr>
P-Access-Network-Info: 3GPP-E-UTRAN-TDD; utran-cell-id-3gpp=0010100010000000
k: 100rel,from-change

Allow: INVITE,ACK,CANCEL,BYE,UPDATE,PRACK,MESSAGE,REFER,NOTIFY,INFO

v=0
o=root 5000 1000 IN IP4 192.168.1.1
s=QC VOIP
c=IN IP4 192.168.1.1
t=0 0
m=audio 50010 RTP/AVP 107 101
b=AS:30
b=RS:0
b=RR:0
a=rtpmap:107 AMR-WB/16000
a=fmtp:107 octet-align=1;mode-set=2;mode-change-capability=2;max-red=0
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
a=sendrecv
a=maxptime:20
a=ptime:20

BYE sip:001010123456789@192.168.1.1:5060 SIP/2.0
Via: SIP/2.0/UDP 192.168.1.2:60126;branch=z9hG4bKe9f77cafd88b452dab9752198ad5e94f2c;rport;transport=udp
Via: SIP/2.0/UDP 192.168.1.2:60115;branch=z9hG4bKf3b6a856a57d467e9437f54d214995eaae85bb3f
Max-Forwards: 69
Call-ID: c64488da3d6644409c0b6324e3cd911c
CSeq: 9002 BYE
To: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=733280944
From: <sip:0123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=1111111111
User-Agent: Anritsu-VirtualUA/4596
Content-Length: 0
Privacy: none
P-Asserted-Identity: <sip:0123456789@ims.mnc001.mcc001.3gppnetwork.org>
Record-Route: <sip:192.168.1.2;lr>

SIP/2.0 200 OK
Via: SIP/2.0/UDP 192.168.1.2:60126;branch=z9hG4bKe9f77cafd88b452dab9752198ad5e94f2c;rport;transport=udp,SIP/2.0/UDP 192.168.1.2:60115;branch=z9hG4bKf3b6a856a57d467e9437f54d214995eaae85bb3f
Call-ID: c64488da3d6644409c0b6324e3cd911c
CSeq: 9002 BYE
To: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=733280944
From: <sip:0123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=1111111111

Content-Length: 0
Record-Route: <sip:192.168.1.2;lr>
P-Access-Network-Info: 3GPP-E-UTRAN-TDD; utran-cell-id-3gpp=0010100010000000

4. eSRVCC (LTE --> GSM)

SIP 消息：

None

说明：

None

空口消息如下：

No.	Progress Time	BTS	Direction	Message
1	09:16.8	LTE1	UL	RRC CONNECTION REQUEST
2	09:16.9	LTE1	UL	RRC CONNECTION SETUP COMPLETE
3	09:17.1	LTE1	DL	EMM: AUTHENTICATION REQUEST
4	09:17.2	LTE1	UL	EMM: AUTHENTICATION RESPONSE
5	09:17.2	LTE1	DL	EMM: SECURITY MODE COMMAND
6	09:17.2	LTE1	UL	EMM: SECURITY MODE COMPLETE
7	09:17.2	LTE1	DL	SECURITY MODE COMMAND
8	09:17.2	LTE1	UL	SECURITY MODE COMPLETE
9	09:17.3	LTE1	DL	UE CAPABILITY ENQUIRY
10	09:17.3	LTE1	UL	UE CAPABILITY INFORMATION
11	09:17.6	LTE1	DL	RRC CONNECTION RECONFIGURATION
12	09:17.7	LTE1	UL	RRC CONNECTION RECONFIGURATION COMPLETE
13	09:36.4	LTE1	DL	MOBILITY FROM EUTRA COMMAND
14	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
15	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
16	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
17	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
18	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
19	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
20	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
21	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
22	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
23	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS

24	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
25	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
26	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
27	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
28	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
29	09:36.6	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
30	09:36.7	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
31	09:36.7	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
32	09:36.7	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
33	09:36.7	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
34	09:36.7	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
35	09:36.7	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
36	09:36.9	GSM/GPRS2	UL	RR: HANDOVER COMPLETE
37	09:37.0	GSM/GPRS2	UL	RR: GPRS SUSPENSION REQUEST
38	09:47.9	GSM/GPRS2	DL	CC: DISCONNECT
39	09:48.1	GSM/GPRS2	UL	CC: RELEASE
40	09:48.2	GSM/GPRS2	DL	CC: RELEASE COMPLETE
41	09:48.2	GSM/GPRS2	DL	RR: CHANNEL RELEASE
42	09:50.4	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
43	09:50.5	GSM/GPRS2	DL	RR: IMMEDIATE ASSIGNMENT
44	09:50.6	GSM/GPRS2	UL	MM: LOCATION UPDATING REQUEST
45	09:50.6	GSM/GPRS2	DL	MM: AUTHENTICATION REQUEST
46	09:50.9	GSM/GPRS2	UL	RR: GPRS SUSPENSION REQUEST
47	09:52.1	GSM/GPRS2	UL	MM: AUTHENTICATION RESPONSE
48	09:52.1	GSM/GPRS2	DL	RR: CIPHERING MODE COMMAND
49	09:52.5	GSM/GPRS2	UL	RR: CIPHERING MODE COMPLETE
50	09:52.5	GSM/GPRS2	DL	MM: IDENTITY REQUEST
51	09:53.2	GSM/GPRS2	UL	MM: IDENTITY RESPONSE
52	09:53.3	GSM/GPRS2	DL	MM: LOCATION UPDATING ACCEPT
53	09:53.9	GSM/GPRS2	UL	MM: TMSI REALLOCATION COMPLETE
54	09:53.9	GSM/GPRS2	DL	MM: MM INFORMATION
55	09:53.9	GSM/GPRS2	DL	RR: CHANNEL RELEASE
56	09:56.5	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
57	09:56.7	GSM/GPRS2	UL	GPRS MM: Routing area update request
58	10:01.7	GSM/GPRS2	UL	RR: CHANNEL REQUEST / HANDOVER ACCESS
59	10:01.8	GSM/GPRS2	UL	GPRS MM: Routing area update request
60	10:01.8	GSM/GPRS2	DL	GPRS MM: Authentication & ciphering req
61	10:02.7	LTE1	UL	RRC CONNECTION REQUEST
62	10:02.8	LTE1	UL	RRC CONNECTION SETUP COMPLETE
63	10:27.7	LTE1	UL	RRC CONNECTION REQUEST
64	10:27.7	LTE1	UL	RRC CONNECTION SETUP COMPLETE
65	10:28.2	LTE1	DL	EMM: AUTHENTICATION REQUEST
66	10:28.3	LTE1	UL	EMM: AUTHENTICATION RESPONSE

67	10:28.4	LTE1	DL	EMM: SECURITY MODE COMMAND
68	10:28.4	LTE1	UL	EMM: SECURITY MODE COMPLETE
69	10:28.4	LTE1	DL	EMM: TRACKING AREA UPDATE ACCEPT
70	10:28.5	LTE1	UL	EMM: TRACKING AREA UPDATE COMPLETE
71	10:28.5	LTE1	UL	ESM: BEARER RESOURCE MODIFICATION REQUEST
72	10:28.5	LTE1	DL	EMM: EMM INFORMATION
73	10:28.5	LTE1	DL	RRC CONNECTION RELEASE
74	10:37.1	LTE1	UL	RRC CONNECTION REQUEST
75	10:37.1	LTE1	UL	RRC CONNECTION SETUP COMPLETE
76	10:37.3	LTE1	DL	EMM: AUTHENTICATION REQUEST
77	10:37.4	LTE1	UL	EMM: AUTHENTICATION RESPONSE
78	10:37.4	LTE1	DL	EMM: SECURITY MODE COMMAND
79	10:37.4	LTE1	UL	EMM: SECURITY MODE COMPLETE
80	10:37.5	LTE1	DL	SECURITY MODE COMMAND
81	10:37.5	LTE1	UL	SECURITY MODE COMPLETE
82	10:37.5	LTE1	DL	UE CAPABILITY ENQUIRY
83	10:37.5	LTE1	UL	UE CAPABILITY INFORMATION
84	10:37.8	LTE1	DL	RRC CONNECTION RECONFIGURATION
85	10:37.9	LTE1	UL	RRC CONNECTION RECONFIGURATION COMPLETE
86	10:37.9	LTE1	UL	ESM: BEARER RESOURCE MODIFICATION REQUEST
87	10:38.7	LTE1	DL	RRC CONNECTION RECONFIGURATION
88	10:38.8	LTE1	UL	RRC CONNECTION RECONFIGURATION COMPLETE
89	10:38.8	LTE1	UL	ESM: DEACTIVATE EPS BEARER CONTEXT ACCEPT

具体的 SIP 消息：

None

4. SMS over PS (Receive)

SIP 消息(安立 MD8475A 是通过 4G 发送的，无 SIP 消息)：

None

说明：

None

空口消息如下：

No.	Progress Time	BTS	Direction	Message

1	04:54.3	LTE1	DL	EMM: DOWNLINK NAS TRANSPORT
2	04:54.3	LTE1	UL	EMM: UPLINK NAS TRANSPORT
3	04:54.3	LTE1	UL	EMM: UPLINK NAS TRANSPORT
4	04:54.3	LTE1	DL	EMM: DOWNLINK NAS TRANSPORT

具体的 SIP 消息：

None

5. SMS over PS (Send)

SIP 消息(安立 MD8475A 是通过 4G 发送的，无 SIP 消息)：

None

说明：

None

空口消息如下：

No.	Progress Time	BTS	Direction	Message
1	07:12.8	LTE1	UL	EMM: UPLINK NAS TRANSPORT
2	07:13.0	LTE1	DL	EMM: DOWNLINK NAS TRANSPORT
3	07:13.0	LTE1	DL	EMM: DOWNLINK NAS TRANSPORT
4	07:13.0	LTE1	UL	EMM: UPLINK NAS TRANSPORT

具体的 SIP 消息：

None

6. Deregister

SIP 消息：

Request: REGISTER sip:ims.mnc001.mcc001.3gppnetwork.org (remove 1 binding)

Status: 200 OK (removed 1 binding)

说明：

[MS --> NW] 手机断网

[NW --> MS] 网络回复 200 OK

空口消息如下：

No.	Progress Time	BTS	Direction	Message
1	35:39.5	LTE1	UL	EMM: DETACH REQUEST
2	35:39.5	LTE1	DL	RRC CONNECTION RELEASE

具体的 SIP 消息：

REGISTER sip:ims.mnc001.mcc001.3gppnetwork.org SIP/2.0

f: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=561512215

t: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>

CSeq: 561118705 REGISTER

i: 561118703_185011576@192.168.1.1

v: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK2663585505

Max-Forwards: 70

m: <sip:001010123456789@192.168.1.1:5060>;+g.3gpp.icsi-ref="urn%3Aurn-7%3A3gpp-service.ims.icsi.mmtel";+g.3gpp.smsip;audio;video;+sip.instance="<urn:gsma:imei:86540701-000000-0>"

Route: <sip:192.168.1.2:5060;lr>

P-Access-Network-Info: 3GPP-E-UTRAN-TDD; utran-cell-id-3gpp=0010100010000000

Expires: 0

l: 0

Authorization: Digest username="001010123456789@ims.mnc001.mcc001.3gppnetwork.org",realm="ims.mnc001.mcc001.3gppnetwork.org",uri="sip:ims.mnc001.mcc001.3gppnetwork.org",qop=auth,nonce="CLbTJJy/i9v58SuI+qGHORfY6u2scYAACKfxF9jqbaw=",nc=00000002,cnonce="561118695",algorithm=AKAv1-MD5,response="9ce4d75d9eca39c303bab587355d48ed",opaque="3c6d55553a25424297fe4c604283c04d"

k: path

Allow: INVITE,BYE,CANCEL,ACK,NOTIFY,UPDATE,REFER,PRACK,INFO,MESSAGE,OPTIONS

SIP/2.0 200 OK

Max-Forwards: 70

Via: SIP/2.0/UDP 192.168.1.1:5060;branch=z9hG4bK2663585505

From: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=561512215

To: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>;tag=987654321

Call-ID: 561118703_185011576@192.168.1.1

CSeq: 561118705 REGISTER

Allow: INVITE, ACK, CANCEL, BYE, PRACK, MESSAGE

Date: Sat, 15 Nov 2014 16:52:20 GMT

P-Associated-URI: <sip:001010123456789@ims.mnc001.mcc001.3gppnetwork.org>

Contact: <sip:001010123456789@192.168.1.1:5060>;+g.3gpp.icsi-ref="urn%3Aurn-7%3A3gpp-service.ims.icsi.mmtel";+g.3gpp.smsip;audio;video;+sip.instance="<urn:gsma:imei:86540701-000000-0>";expires=0

Content-Length: 0

三、参考文档

1.SIP 消息

《41-融合通信接口规范（终端-平台接口分册）v1.0.0（技术参考版）.pdf》

《41-融合通信接口规范（终端-平台接口分册）v1.0.0（技术参考版）20140716.docx》

(两个文档内容一样，word 格式易于搜索)

本标准规定了融合通信终端与平台之间交互所涉及的通信接口，是融合通信终端及平台网元设备需要遵从的技术文件，供中国移动内部使用，为融合通信平台业务的开发、建设、维护，以及融合通信终端的设计提供技术依据。

《IMS：IP 多媒体子系统概念与服务》 (原书第 3 版) -- 纸质书籍

不仅描述了 IMS 关键概念、体系结构、主要过程和典型业务，而且针对 IMS 多媒体电话、IMS 语音呼叫连续性、IMS 转接、IMS 本地号码、紧急会话、IMS

中的通信服务标识、支持固网接入的新的认证模型、NAT 穿越和全球可路由用户代理 URI 等新内容进行了深入浅出的剖析。《IMS:IP 多媒体子系统概念与服务(原书第 3 版)》内容远远超越了简单的协议介绍，通过翔实而生动的典型流程和举例深入地揭示了 IMS 系统设计背后的思想和理念。《IMS:IP 多媒体子系统概念与服务(原书第 3 版)》共分 3 部分，有 13 章，详细地分析了 IMS 注册、IMS 多媒体电话以及语音呼叫连续性的例子，对每个实体上的过程进行详细介绍。

2. 空中接口消息

《VoLTE 终端测试规范——通信功能和性能分册 V1.0.0（报批稿）.pdf》

本标准规定了中国移动 VoLTE 终端通信功能和性能测试方法以及相关测试用例，包括 IMS 基本过程、补充业务、短消息能力、移动性以及性能测试，供中国移动内部和厂商共同使用；适用于中国移动 VoLTE 终端，是中国移动通信集团公司及省公司内部进行的 VoLTE 终端功能和性能测试时的技术依据。

3. 高通的文档

《80-NF124-1_D.pdf》

网络结构，注册、呼叫流程介绍，较详细

《80-NE962-1_A_LTE_AS_Typical_Field_Scenarios_Checklists.pdf》

check list & log keyword

《80-N9839-1_G_IMS_Config_Overview.pdf》

对 IMS 涉及的 NV 参数的详细说明

《AU80-NJ394-1_A_IMS_VT_Overview.pdf》

视频电话流程

《80-NP815-1_A_E911_Call_Flows_Log_Analysis_Overview.pdf》

紧急呼叫流程

《80-NP686-1_B_Configuring_UE_Using_Binary_Modem_Configuration.pdf》

二进制 Modem 配置(CMCC 测试相关)

《80-NP425-1_C_CMCC_Device_Config_Testing_Information.pdf》

CMCC 测试配置手机