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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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1 Scope

This document specifies the media plane control protocols and interactions with the media needed to support Mission Critical Push To Talk (MCPTT).

This document specifies protocol for using pre-established session to setup calls, floor control and managing MBMS subchannels over MBMS bearers on-network and off-network protocols for floor control.

Mission critical communication services are services that require preferential handling compared to normal telecommunication services, e.g. in support of police or fire brigade. Floor control provides a mechanism for managing the right to transmit at a point in time during an MCPTT call.

The MCPTT service and its associated media plane control protocols can be used for public safety applications and also for general commercial applications (e.g., utility companies and railways).

This document is applicable to User Equipment (UE) supporting the floor participant functionality, setting up calls using pre-established SIP sessions and using MBMS bearers for group communication and to floor control servers supporting these functions in the MCPTT system.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 24.379: "Mission Critical Push To Talk (MCPTT) call control Protocol specification".

[3] IETF RFC 3550: "RTP: A Transport Protocol for Real-Time Applications".

[4] 3GPP TS 24.383: "Mission Critical Push To Talk (MCPTT) Management Object (MO)".

[5] 3GPP TS 23.179: "Functional architecture and information flows to support mission critical communication services; Stage 2".

[6] 3GPP TS 29.468: "Group Communication System Enablers for LTE (GCSE_LTE); MB2 Reference Point; Stage 3".

[7] IETF RFC 5761: "Multiplexing RTP Data and Control Packets on a Single Port".

[8] IETF RFC 3711: "The Secure Real-time Protocol (SRTP)".

[9] 3GPP TS 25.446: "MBMS synchronization protocol (SYNC)".

[10] 3GPP TS 29.281: "General Packet Radio System (GPRS) Tunnelling Protocol User Plane (GTPv1-U)".

[11] 3GPP TS 24.008: "Mobile radio interface layer 3 specification; Core Network protocols; Stage 3".

[12] 3GPP TS 24.381: "Mission Critical Push To Talk (MCPTT) group management Protocol specification".

[13] 3GPP TS 24.384: "Mission Critical Push To Talk (MCPTT) configuration management protocol specification".

[14] 3GPP TS 33.179: "Security of Mission Critical Push-To-Talk (MCPTT)".

[15] IETF RFC 3830: "MIKEY: Multimedia Internet KEYing".

[16] IETF RFC 3711: "The Secure Real-time Transport Protocol (SRTP)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term or definition defined in the present document takes precedence over the definition of the same term or definition, if any, in 3GPP TR 21.905 [1].

Active floor request queue: The floor request queue used by the floor control server to queue received Floor Request messages.

Controlling MCPTT function: The MCPTT server performing a controlling role.

Conversation: A number of media bursts exchanged between participants in a group call session.

MBMS bearer: The service provided by the EPS to deliver the same IP datagrams to multiple receivers in a designated location.

MBMS subchannel: A logical channel which uses resources of an activated and announced MBMS bearer identified by the TMGI of the MBMS bearer and additional parameters, like UDP port, associated to a group or the MBMS subchannel used to e.g. inform when a conversation in a group call is started or ended.

NOTE: In this release of the specifications the UDP port is the only parameter used for enabling the differentiation of media and media plane control packets belonging to different groups over the same MBMS bearer by a receiving MCPTT client.

Media burst: A flow of media from an MCPTT client that has the permission to send media.

Media plane control protocols: Protocols in the media plane used for floor control, pre-established session call control and MBMS subchannel control.

Participating MCPTT function: The MCPTT server performing a participating role.

Passive floor request queue: The floor request queue used by the non-controlling MCPTT function to store received Floor Request messages for monitoring purposes.

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.179 [5] apply:

Floor control
Floor participant
Floor control server
Group call
MCPTT call
MCPTT server performing a controlling role
MCPTT server performing a participating role
MCPTT user
Mission critical push to talk
Private call
SIP core

For the purposes of the present document, the following terms and definitions given in 3GPP TS 24.379 [2] apply:

Non-controlling MCPTT function of an MCPTT group

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

AS	Application Server
D2D	Device to Device
DL	Downlink
GCS AS	Group Communication Service Application Server
GMK	Group Management Key
GMS	Group Management Server
GUK-ID	Group User Key Identifier
IP	Internet Protocol
MBMS	Multimedia Broadcast and Multicast Service
MCCP	Mission Critical MBMS subchannel Control Protocol
MCPTT	Mission Critical Push To Talk
MKI	Master Key Identifier
PCK	Private Call Key
PCK-ID	Private Call Identifier
PTT	Push-To-Talk
RFC	Request For Comment
RTCP	RTP Control Protocol
RTP	Real-time Transport Protocol
SRTCP	Secure RTCP
SRTP	Secure RTP
SSRC	Synchronization source
TEK	Traffic-Encrypting Key
TMGI	Temporary Mobile Group Identity
UE	User Equipment

4 General

4.1 Overview

4.1.1 Floor Control

4.1.1.1 General

In a PTT group call after the call is setup, at a given time only a single group member is allowed to talk and all other affiliated group members listen to this talker. The control action for obtaining this mode of operation is known as floor control. The direct actors of floor control are the floor participants and the floor control server. A floor participant does the floor control related actions in the MCPTT client. The floor control server is the decision maker of the floor control. In on-network the floor control server is in the MCPTT server with the controlling role. In off-network no specific floor control server exists. The current talker plays the role of floor control server.

Floor control actions in on-network are described in subclause 4.1.1.2. The differences for off-network floor control are described in subclause 4.1.1.3.

NOTE: End-user actions as operation of the PTT button illustrates functionality but no end-user actions are mandated by this specification.

4.1.1.2 On-network floor control

At any point in time a group member can request permission to talk.

When all group members are silent, a group member can press the PTT button, meaning the request for permission to talk. The floor participant entity of this user reflects this request to the floor control server by sending a Floor Request message. If the floor control server decides to permit, it informs this permission for this request by sending a Floor Granted message to the requesting group member. The floor control server informs the initiation of the talk to the other group members by sending a Floor Taken message. Once the group member receives the permission, a permission indication (permission tone) is generated and the user can talk. The media packets (encoded voice) are sent to the controlling MCPTT server and from there they are distributed to all listeners of this group. The release of the PTT button indicates the user"s intension to end talking. Once the PTT button is released, the floor participant sends a Floor Release message to the floor control server indicating that this user has finished talking. This cycle, starting from the Floor Granted message and ending with Floor Release message, is known as 'talk burst' or 'media burst'.

In the beginning of a call the initial talk permission request can be implied by the SIP message which initiates the call as specified in 3GPP TS 24.379 [2] without any specific Floor Request message.

A group member can also request for permission to talk by sending a Floor Request message during a talk burst. The floor control server can resolve this request in several ways.

1. If this request has higher priority than the ongoing talk burst, the floor control server revokes the current talk burst by sending a Floor Revoke message to the current talker. The current talker is interrupted and the current media burst is ended by the current floor participant by sending a Floor Release message. Then the floor control server sends a Floor Granted message to the revoking user and send Floor Taken message to other group members. Then a new media burst starts.

2. If this request does not have higher priority and floor request queueing is not used the floor control server rejects this request by sending a Floor Deny message to the requester. Then a reject indication (reject tone) is generated for the user. The ongoing talk burst continues.

3. If request queueing is used the floor control server sends Floor Queue Position Info message indicating that there is no permission but the request is queued for potential permission when the current talk burst ends. Then a "queued" indication is generated for the user. The ongoing talk burst continues.

During a talk burst, a queued user can ask its position in the queue by sending a Floor Queue Position Request message. Then the floor controller server provides the information by sending Floor Queue Position Info message. A queued user can also remove itself from the queue bay sending a Floor Release message. This kind of message exchange during a talk burst does not affect the ongoing talk burst.

If request queueing is used, by the end of the talk burst, the floor control server gives the talk permission to the first pending request in the queue. For this, it sends the same messages as in the beginning of a talk burst; Floor Granted message to the permitted user and Floor Taken message to other group members. The permitted user is expected to press the PTT button after the permission tone within a well-defined short period of time. If PTT button is pressed the media burst continues normally until it is released. If not, the MCPTT client loses the talk permission.

If queueing is used the ordering in the queue is affected by the priority of the users in the queue.

A floor request with pre-emptive priority can be granted without revoking the current speaker. In this case media from both the overridden current talker and the overriding MCPTT user is distributed to selected participants at the same time. The list of participants that receive the overriding, overridden, or both transmissions is based on configuration.

During silence (when no talk burst is ongoing), the floor control server can send Floor Idle message to all floor participants from time to time. The floor control server sends Floor Idle message in the beginning of silence.

Some of the floor control messages can be repeated as specified in state machines specified in clause 6.

The call can be released after a long silence period.

4.1.1.3 Off-network floor control

This subclause describes the special features for off-network floor control with respect to the on-network floor control.

In off-network no specific floor control server exists. All floor control messages are sent to all group members.

When a floor control server gives talk permission it sends a Floor Granted message. The information element which expresses the group member, to which this talk permission is given, implies to the other group members that the floor is taken. No other Floor Taken message is sent.

After silence, a floor participant asks for talk permission by sending a Floor Request message. After a well-defined waiting period, if no response is received, this floor participant sends a Floor Granted message indicating itself in the information element which expresses the group member to which this talk permission is given and continues the talk burst.

In off-network, the Floor Idle message is not used.

Some of the floor control messages can be repeated as specified in the state machines specified in clause 7.

4.1.1.4 Determine floor priority

The floor control server can determine how to handle a received Floor Request message using a number of input parameters. Examples of input parameters that the floor control server can use are:

NOTE: In the off-network mode, a floor participant is acting as the floor control server as specified in subclause 7.3.4.

1. the floor priority, using the value of the Floor Priority field in the Floor Request message or the <User Priority> element specified in the 3GPP TS 24.381 [12];
2. the participant type, using the <Participant Type> element specified in 3GPP TS 24.381 [12] or, in case an non-controlling MCPTT function is attached to a group call, the <Participant Type> value in the Track Info field in the Floor Request message;
3. the type of call indicated in the Floor Indicator field; and
4. any other information in the group document specified in 3GPP TS 24.381 [12] or information stored in the controlling MCPTT function outside the scope of the present document.

Using a local policy and the above input parameters the floor control server can determine that a floor request is:

1. pre-emptive such that the current talker is overridden;
2. pre-emptive such that the current talker is revoked;
3. not pre-emptive and put in the floor request queue, if queueing was not negotiated; or
4. not-pre-emptive and rejected, if queueing was not negotiated.

4.1.2 Pre-established session call control

4.1.2.1 General

An MCPTT client can pre-establish a session with the participating MCPTT function for potential use when a call is setup. The establishment, the modification and the release of a pre-established session are specified in 3GPP TS 24.379 [2].

NOTE: The establishment of a pre-established session, for potential use when a call is setup, depends on the policy chosen by the MCPTT service provider.

A pre-established session can be used when initiating a pre-arranged group call, a chat group call or a private call. Similarly a pre-established session can be released for reuse after the termination of a pre-arranged group call, chat group call and private call.

The media plane control messages related to call setup over a pre-established session are sent over the channel used for media plane control. The media plane control messages related to the release of a call which was setup over a pre-established session, without terminating the pre-established session, are sent over the channel used for media plane control. The unicast channel for media plane control is over the MCPTT-4 reference point.

4.1.2.2 Call setup over pre-established session

For a pre-arranged group call, when the originator initiates the call setup indicating the use of a pre-established session using SIP messages as specified in 3GPP TS 24.379 [2], the participating MCPTT function (which serves the

originating MCPTT client) sends to the originating MCPTT client a Connect message after the controlling MCPTT function accepts the initiation of this call. After the reception of this Connect message the originating MCPTT client sends an Acknowledgment message by indicating that the connection is accepted or by indicating that the connection is not accepted. If the connection is accepted by the originating MCPTT client, the floor control for this call continues a specified in clause 6.

For a pre-arranged group call if the controlling MCPTT function as triggered by an originating group member initiates a call as specified in 3GPP TS 24.379 [2], the participating MCPTT function which serves the terminating MCPTT client sends a Connect message to all affiliated MCPTT clients of this group. After the reception of the Connect message the terminating MCPTT client sends an Acknowledgment message by indicating that the connection is accepted or by indicating that the connection is not accepted. If the connection is accepted by the terminating MCPTT client, the floor control for this call continues a specified in clause 6.

NOTE: If a terminating client does not have an available pre-established session, the call setup proceeds as in on-demand call setup as specified in 3GPP TS 24.379 [2].

For a chat group call, a group member can use a pre-established session when joining the chat group using SIP messages as specified in 3GPP TS 24.379 [2]. For a group member that has already joined the chat group call, the floor control between the MCPTT client (floor participant) and the MCPTT server (floor control server) continues as specified in clause 6.

For a private call the procedures for the originator are the same as the originator initiating a call for a pre-arranged call setup over a pre-established session, with the difference that the recipient of the call is a private user and not a pre-arranged group.

For a private call if the controlling MCPTT function as triggered by the originator initiates a call as specified in 3GPP TS 24.379 [2], the participating MCPTT function (which serves the terminating MCPTT client) sends a Connect message to the terminating MCPTT client served by the participating MCPTT function if this MCPTT client has an available pre-established session and the commencement mode is automatic. If the commencement mode is manual the terminating MCPTT client is invited using SIP procedures as specified in 3GPP TS 24.379 [2].

4.1.2.3 Release of a call which uses a pre-established session

When a call is released by the controlling MCPTT function (as specified in 3GPP TS 24.379 [2]), the participating MCPTT function sends a Disconnect message to all MCPTT clients which used a pre-established session for this call. Then the call is released (see also 3GPP TS 24.379 [2]) and the pre-established session can be used for another call.

When an MCPTT client leaves a call (as specified in 3GPP TS 24.379 [2]) which was setup over a pre-established session without releasing the pre-established session, this pre-established session can be used for another call.

A call setup over a pre-established session can also be released by using the specifications in 3GPP TS 24.379 [2] (without the use of Disconnect message) as a result the pre-established session, which has been used for this call, is also released.

4.1.3 MBMS subchannel control

4.1.3.1 General

The participating MCPTT function can use an MBMS bearer for the DL transmission of the media and the media control plane.

The participating MCPTT function decides to activate an MBMS bearer. After the activation of the MBMS bearer, as specified in 3GPP TS 29.468 [6], the TMGI of this MBMS bearer is announced to the MCPTT clients in the MBMS service area of this MBMS bearer. This announcement enables the MCPTT client to listen (decode/demodulate) this MBMS bearer. The activation of an MBMS bearer and the announcement of the TMGI create a pool of MBMS subchannel resources without any association to a group or other purposes.

The criteria for a participating MCPTT function to decide to activate and use an MBMS bearer is implementation dependent.

An MBMS bearer can be used for the DL transmission for more than one group. For this, additional parameters like destination UDP port are used for enabling the differentiation of messages and packets belonging to different groups over the same MBMS bearer by a receiving MCPTT client.

When a TMGI is announced a general purpose MBMS subchannel is created by defining an association between the identity of the general purpose MBMS subchannel (e.g. 'general purpose') and the TMGI (of the activated and announced MBMS bearer) together with the parameters (e.g. UDP port) differentiating this general purpose MBMS subchannel in this MBMS bearer. The parameters of this general purpose MBMS subchannel can be communicated to the MCPTT clients in the MBMS service area of this MBMS bearer using unicast over-the air transmission or can be pre-defined and stored in the MCPTT user profile that is downloaded to the MCPTT UE.

4.1.3.2 Start of a conversation

When a conversation is started (by an originating MCPTT client of a group) the participating MCPTT function can allocate an MBMS subchannel for this group by defining an association between this group (e.g. 'group id') and the TMGI (of the activated and announced MBMS bearer) with the parameters differentiating this MBMS subchannel in this MBMS bearer. The parameters of this MBMS subchannel are sent using the general purpose MBMS subchannel using the Map Group To Bearer message. The Map Group To Bearer message is repeated as long as the conversation is ongoing for improving the reception probability and to allow MCPTT clients arriving late to listen to the MBMS subchannel.

The same MBMS subchannel can be used for media and media control plane of an MCPTT group, subjected to the restrictions stated in IETF RFC 5761 [7].

4.1.3.3 During a conversation

If an MBMS subchannel exists, the participating MCPTT function forwards the media plane control messages, received from the controlling MCPTT function via MBMS subchannel for media plane control. Only floor control messages which are transmitted to more than one affiliated group member are forwarded to the MBMS bearer (e.g. the Floor Taken and Floor Idle messages). The floor control messages can be repeated by configurable number of times for improving the reception probability. The participating MCPTT function forwards the media packets, received from the controlling MCPTT function, via the MBMS subchannel for media.

Amongst all affiliated group members under this participating MCPTT function, the participating MCPTT function is informed or is enabled to deduce the group members which do not or cannot receive the MBMS subchannels. The participating MCPTT function forwards the media packets and the media plane control messages, received from the controlling MCPTT function, to the group members which do not or cannot receive the MBMS subchannels, using unicast bearers allocated for media and media plane control respectively.

4.1.3.4 Ending the conversation

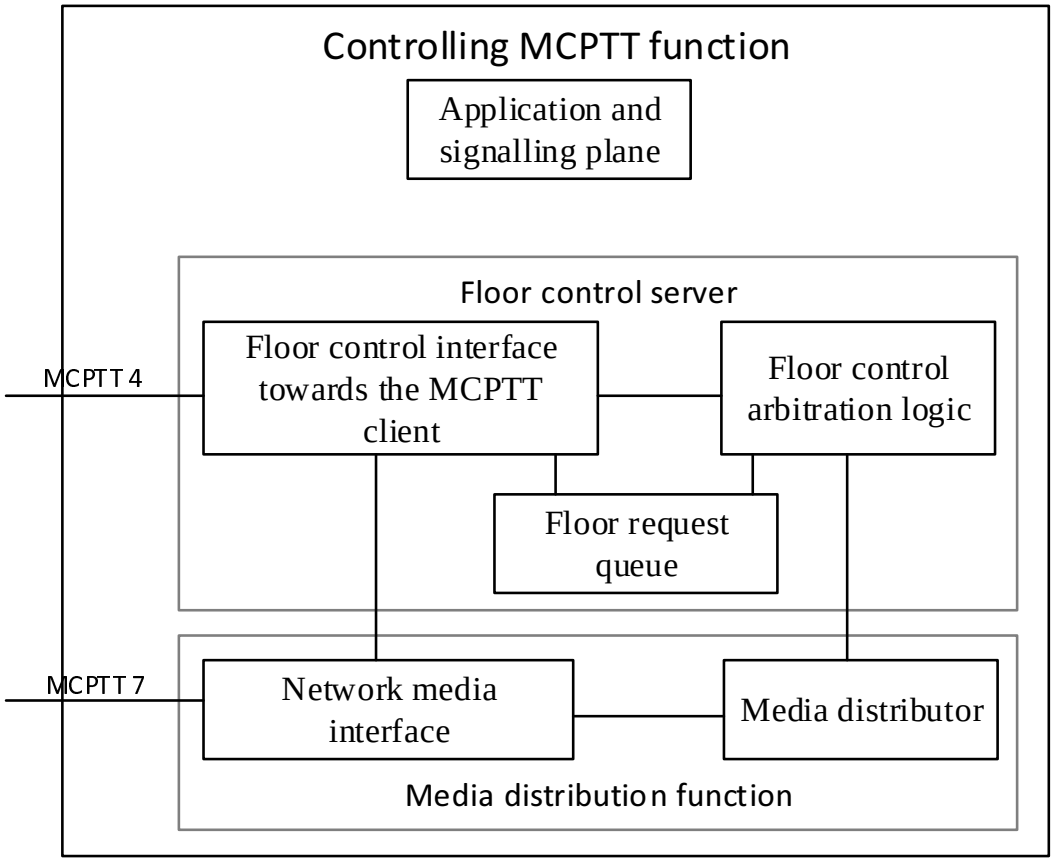
The participating MCPTT function can de-allocate an MBMS subchannel after a configurable period of silence in the conversation by removing the association to this group by sending the Unmap Group To Bearer message over this MBMS subchannel. The de-allocation of the MBMS subchannel frees the parameters used for differentiating this MBMS subchannel in this MBMS bearer. Therefore, the resources of a de-allocated MBMS subchannel can be reallocated for a conversation of another group.

NOTE: The participating MCPTT function will activate MBMS bearers with general QoS characteristics suitable for MCPTT service and will map MBMS subchannels for media or media plane control only to MBMS bearers that can provide the QoS required by media or media plane control.

4.2 Internal structure of media plane control entities

4.2.1 Controlling MCPTT function

According to 3GPP TS 23.179 [5] the controlling MCPTT function is divided into a floor control server and a media distribution function. In the present document the internal structure of the MCPTT server is illustrated in figure 4.2-1.



NOTE: The real internal structure of the MCPTT server is implementation specific but a possible internal structure is shown to illustrate the procedures.

Figure 4.2.1-1: Internal structure of floor control in the controlling MCPTT function

All entities in the controlling MCPTT function are assumed to have a direct communication interface to the application and signalling plane. The interface to the application and signaling plane carries information about SIP session initialisation and SIP session release, SDP content, etc.

The reference points MCPTT-4 and MCPTT-7 are described in 3GPP TS 23.179 [5].

The floor control interface towards the MCPTT client receives and transmitts the floor control messages from and to the MCPTT client. The procedures are controlled by a state machine described in subclause 6.3.5. One state machine is needed for each MCPTT client participating in an MCPTT call.

The floor control arbitration logic is performing the floor control. The floor control arbitration logic is controlled by a state machine described in subclause 6.3.4. One state machine is needed per MCPTT call.

The floor request queue is accessible both by the floor control interface towards the MCPTT client for all MCPTT clients in the call and the floor control arbitration logic.

The network media interface is receiving and sending media from and to the associated MCPTT client. The network media interface is out of scope of the present document. One network media interface is needed for each MCPTT client participating in an MCPTT call.

The media distributor is controlled by the floor control arbitration logic. The media distributor is out of scope of the present document. One media distributor is needed per MCPTT call.

The internal interfaces are assumed to transport the following type of information.

1. The interface between the network media interface and the floor control interface towards the MCPTT client:

    a. Indication that the network media interface has started to receive media packets from the associated MCPTT client or that media packets are no longer received from the associated MCPTT client.

NOTE: It is an implementation option whether an indication e.g. is sent for every received RTP media packet or only when the first packet is received and then when no more RTP packets are received.

2. The interface between the floor control interface towards the MCPTT client and the floor control arbitration logic:

   a. Floor control messages to and from the associated MCPTT client, requests to create or delete the state machine instance for the associated MCPTT client. The floor control message to the floor control arbitration logic are limited to floor control messages that will change the state of the floor.

3. The interface between the network media interface and the media distributor:

   a. Media to and from associated MCPTT clients. This interface is out of scope of the present document.

4. The interface between the floor control arbitation logic and the media distributor:

   a. Requests to start or stop distributing media to participants in the MCPTT call. Indication that the media distributor has started to receive media packets from the network media interface associated with the MCPTT client with the permission to send media or that media packets are no longer received from the network media interface from the associated MCPTT client.

5. The interface between the floor control interface towards the MCPTT client and the floor request queue:

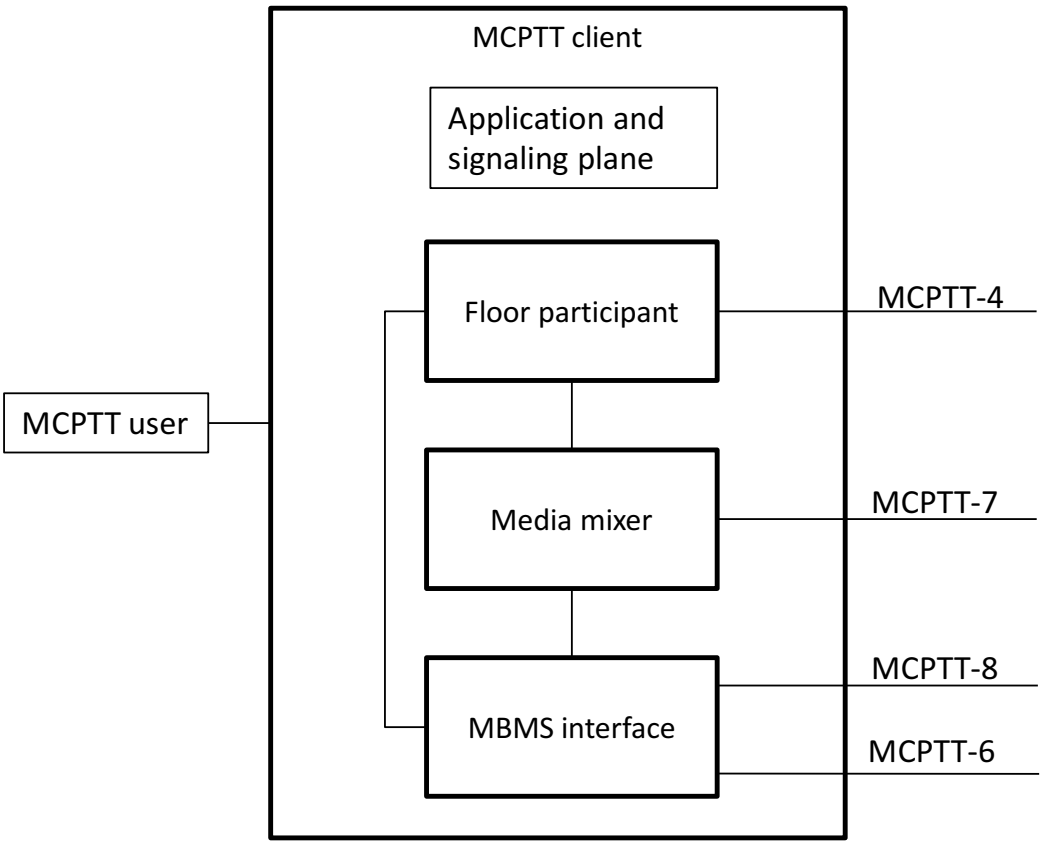
   a. Requests to store received Floor Request messages in the queue or requests to remove Floor Request messages from the queue and the queue content for building the Floor Queue Position Info message.

6. The interface between the floor control arbitration logic and the floor request queue:

   a. Requests to store received Floor Request messages in the queue or requests to remove Floor Request messages from the queue. Indications that the queue is modified.

4.2.2 MCPTT client

According to 3GPP TS 23.179 [5] the MCPTT client is divided into a floor participant and a media mixer function. In the present document the internal structure of the MCPTT client is illustrated in figure 4.2.2-1.



NOTE: The real internal structure of the MCPTT client is implementation specific but a possible internal structure is shown to illustrate the logic and the procedures.

Figure 4.2.2-1: Internal structure of the MCPTT client

All entities in the MCPTT client have a direct communication interface to the application and signalling plane. The interface to the application and signaling plane carries information about SIP session initialisation and SIP session release, SDP content, etc.

The reference points MCPTT-4, MCPTT-6, MCPTT-7 and MCPTT-8 are described in 3GPP TS 23.179 [5].

The floor participant receives and sends floor control and pre-established session control message over the unicast bearer.

The media mixer receives and sends RTP media packets over the unicast bearer. The media mixer indicates to the floor participant when RTP media packets are received and when RTP media packets are no longer received. The floor participant instructs the media mixer on how to handle media received from the user or received from the network either over the unicast bearer or over the MBMS bearer.

The MBMS interface receives RTP media packets over the MBMS bearer. The RTP media packets are forwarded to the media mixer.

The MBMS interface receives floor control messages and MBMS subchannel control messages over the MBMS bearer. The MBMS interface forward received floor control messages to the floor participants.

The floor participant receives indication from the MCPTT client when the MCPTT user has pressed or released the PTT button. The MCPTT client can also provide notification towards the MCPTT user. Voice received from the MCPTT user is, on instruction from the floor participant, encoded by the media mixer and sent as RTP media packets over the unicast bearer.

4.2.3 Participating MCPTT function

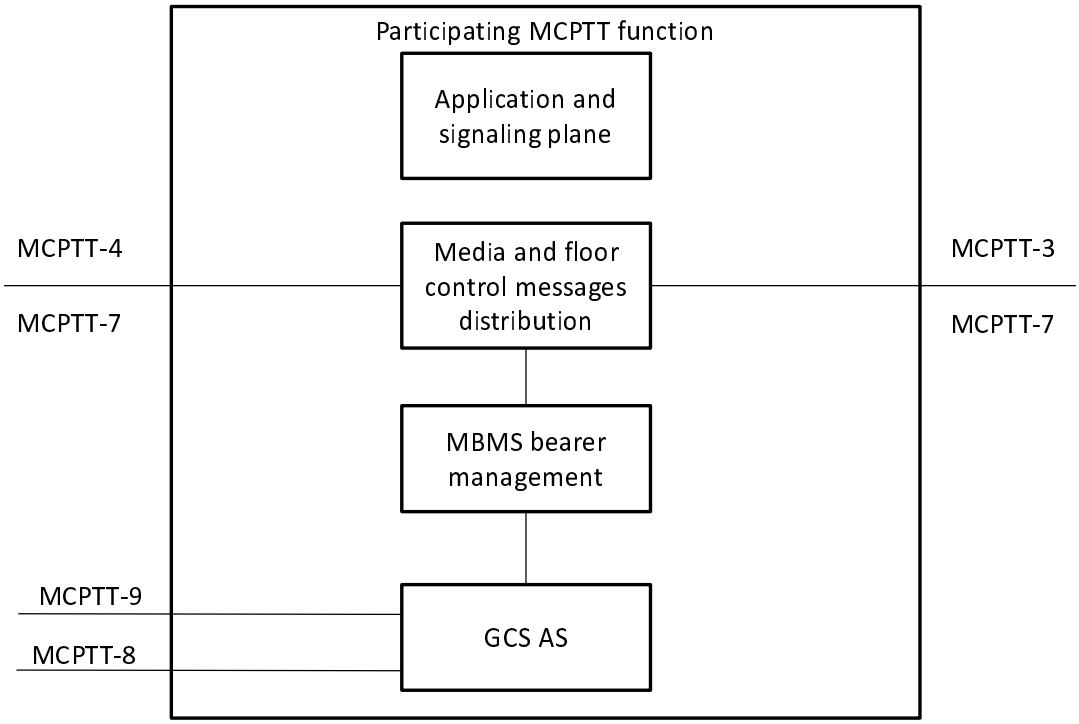
4.2.3.1 General

The participating MCPTT function performs the participating role of an MCPTT server as defined in 3GPP TS 23.179 [5]. The participating MCPTT function uses media plane control (non-SIP) messages when taking part in the floor control procedures as specified in clause 6, call over pre-established session as specified in clause 9 and the use of MBMS Bearer procedures as specified in clause 10. In the sequel the term 'controlling MCPTT function' is used for the entity which performs the controlling role of an MCPTT server.

The following subclauses describe the assumed internal structure of a participating MCPTT function and the role of the participating function in the floor control procedures, the call over pre-established session procedures and the use of MBMS Bearer procedures.

4.2.3.2 Internal structure of the participating MCPTT function

In the present document the internal structure of the participating MCPTT function is illustrated in figure 4.2.3.2-1.



NOTE: The real internal structure of the participating MCPTT function is implementation specific but a possible internal structure is shown to illustrate the logic and the procedures.

Figure 4.2.3.2-1: Internal structure of the MCPTT client

All entities in the participating MCPTT function have a direct communication interface to the application and signalling plane. The interface to the application and signalling plane carries information about SIP session initialisation and SIP session release, SDP content, etc.

The reference points MCPTT-3, MCPTT-4, MCPTT-7, MCPTT-8 and MCPTT-9 are described in 3GPP TS 23.179 [5].

The media and floor control message distribution receives media control messages and RTP media packets to and from the MCPTT client and the controlling MCPTT function. Media plane control messages and RTP packets are forwarded as received when unicast bearers are used. If MBMS bearers are used floor control messages, MBMS subchannel control messages and RTP media packets are sent to the MBMS bearer management.

The MBMS bearer management receives floor control message and RTP media packets from the media and floor control message distribution when floor control messages and RTP media packets are sent over an MBMS bearer. MBMS bearer management also generates MBMS subchannel control message. Floor control message, RTP media

packets and MBMS subchannel control messages are sent to the GCS AS for distribution over an MBMS bearer. The GCS AS is outside the scope of the present specification.

4.2.3.3 The roles of the participating MCPTT function

4.2.3.3.1 For the floor control procedures

When a floor control message or a media packet is received from an MCPTT client, in the MCPTT-4 and MCPTT-7 reference points respectively, the participating MCPTT function forwards it to the controlling MCPTT function over MCPTT-3 reference point or to the application and signalling plane. When a floor control message or a media packet is received from the controlling MCPTT function, over MCPTT-3 reference point or the application and signalling plane, for MCPTT clients which do not use a MBMS subchannel, the participating MCPTT function forwards the floor control message to the MCPTT client over the MCPTT-4 and MCPTT-7 reference points respectively. For MCPTT clients which use an MBMS subchannel, for floor control messages directed to all of these MCPTT clients and for media packets, the participating MCPTT function forwards a single floor control message or a single media packet using the MBMS subchannel over MCPTT-9 and MCPTT-8 reference points respectively.

When MCPTT clients are listening to the MBMS subchannel multiple copies of the same media packet destined to each individual MCPTT client are sent by the controlling MCPTT function while the participating only forwards one single media packet over the MBMS bearer. Any optimizations for not sending the media packet from the controlling MCPTT function to all MCPTT clients are out of scope of the present document.

When MCPTT clients are listening to the MBMS subchannel multiple copies of the same Floor Idle message and Floor Taken message destined to each individual MCPTT client are sent by the controlling MCPTT function while the participating only forwards one single Floor Idle or Floor Taken message over the MBMS bearer. Any optimizations for not sending the Floor Idle or Floor Taken message from the controlling MCPTT function to all MCPTT clients are out of scope of the present document.

The participating MCPTT function specifications related to the floor control are specified in subclause 6.4 for unicast media and media plane control delivery and in subclause 10.3.3 for MBMS delivery.

4.2.3.3.2 For the call over pre-established session procedures

For a pre-established session between an MCPTT client and the participating MCPTT function, when a call is initiated over this pre-established session, the participating MCPTT function informs the originating MCPTT client the acceptance or rejection decision of the controlling MCPTT function by sending Connect or Disconnect messages respectively over MCPTT-4 reference point. When a call initiation is accepted by the controlling server and informed to the participating MCPTT function, the participating MCPTT function informs the terminating MCPTT client which has a pre-established session the initiation of this call, using Connect message over MCPTT-4 reference point.

When the controlling MCPTT function informs the participating MCPTT function that a call which is setup over a pre-established session is released (either over MCPTT-3 reference point or from application and signalling plane), the participating MCPTT function informs the MCPTT client the release of this call using Disconnect message over MCPTT-4 reference point. By the end of the release of the call the pre-established session is reserved for possible future use.

When an Acknowledgment message is received, over MCPTT-4 reference point, as result of a message informing the MCPTT client for the initiation, the rejection or the release related to a call conducted over a pre-established session, the participating MCPTT function communicates the positive or negative acknowledgment information towards the controlling MCPTT function according to the procedures in 3GPP TS 24.379 [2] (either over MCPTT-3 reference point or from application and signalling plane).

The participating MCPTT function specifications related to the call setup over pre-established session are in subclause 9.3.

4.2.3.3.3 For the use of MBMS bearer procedures

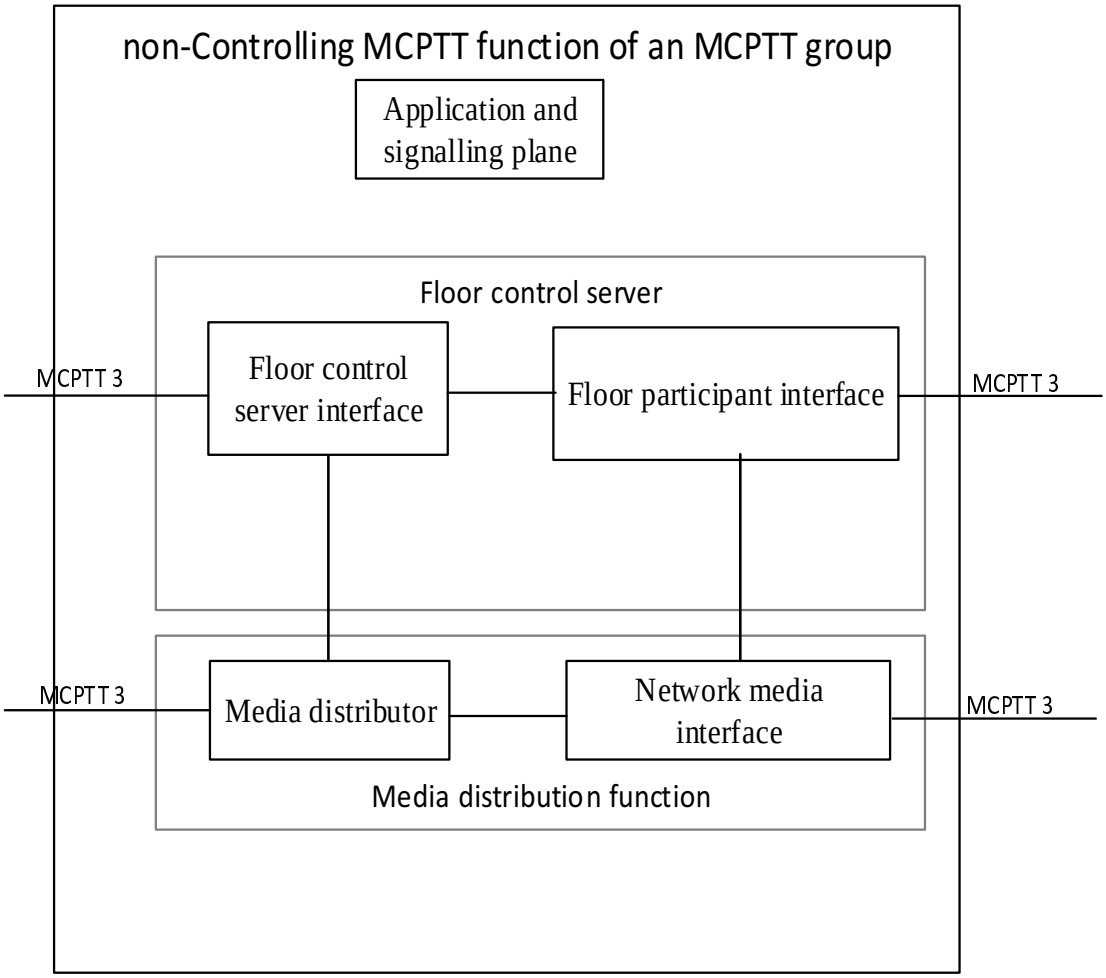
In the initiation of a conversation, if the MBMS bearer management in the participating MCPTT function decides to use an MBMS subchannel for the media plane control messages and the media packets, the participating MCPTT function sends a Map Group To Bearer message over MCPTT-9 reference point, for indicating the association information between the group identity of this call and the TMGI of the MBMS bearer and additional parameters necessary for the identification of this MBMS subchannel using the general purpose MBMS subchannel already associated for the

transmission of this information. In the termination of a conversation the participating MCPTT function sends an Unmap Group To Bearer message for terminating the association between the MBMS subchannel in use for this conversation and the group identity.

The participating MCPTT function specifications related to the declaration of the association between an MBMS bearer and related parameters and the MBMS subchannel for media and media plane control are specified in subclause 10.3.2 and subclause 10.3.4.

4.2.4 Non-controlling MCPTT function of an MCPTT group

According to 3GPP TS 24.379 [2] subclause 5.3 the MCPTT server can act in a non-controlling MCPTT function of an MCPTT group role. In the present document the internal structure of the non-controlling MCPTT function of an MCPTT group is illustrated in figure 4.2.4-1.



NOTE: The real internal structure of the MCPTT server is implementation specific but a possible internal structure is shown to illustrate the logic and the procedures.

Figure 4.2.4-1: Internal structure of the non-controlling MCPTT function

All entities in the non-controlling MCPTT function of an MCPTT group are assumed to have a direct communication interface to the application and signalling plane. The interface to the application and signaling plane carries information about SIP session initialisation and SIP session release, SDP content, etc.

The floor participant interface receives and transmitts the floor control messages from and to the MCPTT client. The procedures are controlled by a state machine described in subclause 6.5.5. One state machine is needed for each MCPTT client participating in an MCPTT call.

The floor control server interface is distributing floor control message to and from the floor control server in the controlling MCPTT function. The floor control server interface procedures are described in subclause 6.5.4. One floor control server interface is needed per MCPTT call.

The network media interface is receiving and sending media from and to the associated MCPTT client. The network media interface is out of scope of the present document. One network media interface is needed for each MCPTT client participating in an MCPTT call.

The media distributor is controlled by the floor control server interface. The media distributor is out of scope of the present document. One media distributor is needed per MCPTT call.

The internal interfaces are assumed to transport the following type of information.

1. The interface between the network media interface and the floor participant interface:

    a. Indication that the network media interface has started to receive media packets from the associated MCPTT client and requests from the floor participant interface to forward received RTP paclets towards the media distributor or to stop forward RTP media packets to the media distributor.

NOTE: It is an implementation option whether an indication e.g. is sent for every received RTP media packet or only when the first packet is received.

2. The interface between the floor participant interface and the floor control server interface:

    a. Floor control messages to and from the associated floor participant. The floor control message to the floor control server interface are limited to floor control messages that can result in an action towards the floor control server.

3. The interface between the network media interface and the media distributor:

    a. RTP media packets to and from associated MCPTT clients. This interface is out of scope of the present document.

4. The interface between the floor control server interface and the media distributor:

    a. Requests to start or stop distributing media to participants in the MCPTT call. Indication that the media distributor has started to receive media packets from the network media interface associated with the MCPTT client with the permission to send media.

4.3 The media plane control channel

4.3.1 General

The media plane control channel is used for transport of messages associated with the floor control protocol, the pre-established session call control protocol and the MBMS bearer management protocol, all specified in the present document.

4.3.2 Control channel realization

The media plane control channel is realized by sending RTCP APP packets on top of UDP/IP. RTCP APP packets are defined in IETF RFC 3550 [3]. The MCPTT specific coding of the RTCP APP packets is defined in clause 8 of the present document.

4.3.3 Establishing a media plane control channel

4.3.3.1 General

The MCPTT client and the MCPTT server use the SDP offer/answer mechanism in order to negotiate the establishment of the media plane control channel. This section defines the SDP offer/answer procedures. Generic SDP offer/answer procedures for establishing a session are defined in clause 12.

The media description ("m=" line) associated with the media plane control channel shall have the values as described in table 4.3.3.1-1.

Table 4.3.3.1-1: Media plane control channel media description

Media description element	Value
<media>	"application"
<port>	RTCP port
<proto>	"udp"
<fmt>	"MCPTT"

The port used for RTCP messages associated with the media plane control channel shall be different than ports used for RTCP messages associated with other "m=" lines (e.g. RTP) in the SDP.

NOTE 1: As RTCP is used to transport messages on the media plane control channel, the "m=" line port value indicates an RTCP port. This is different from cases where an "m=" line is associated with an RTP-based stream, and the "m=" line port value indicates an RTP port.

NOTE 2: In case the media plane control channel uses a different IP address than other media described in the SDP, a media plane control channel specific "c=" line also needs to be associated with the "m=" line associated with the media plane control channel.

The format of the optional SDP fmtp attribute, when associated with the media plane control channel, is described in clause 12.

The example below shows an SDP media description for a media plane control channel.

```
m=application 20032 udp MCPTT
a=fmtp:MCPTT mc_queueing;mc_priority=5;mc_granted
```

5 Entities

5.1 General

This clause associates the functional entities with the MCPTT roles described in the stage 2 architecture document (see 3GPP TS 23.179 [5]).

5.2 MCPTT client

5.2.1 Introduction

To be compliant with the procedures in this document, an MCPTT client shall:

1. support the role of an MCPTT client as specified 3GPP TS 23.179 [5];
2. support the on-network MCPTT client role as specified in 3GPP TS 24.379 [2];
3. support the off-network MCPTT client role as specified in 3GPP TS 24.379 [2]; and
4. support media plane security as specified in clause 13.

To be compliant with the on-network procedures in this document, an MCPTT client shall:

1. provide the role of a floor participant in on-network mode as specified in subclause 5.2.2;
2. provide the media mixer function as described in subclause 4.2.2 and support the related procedures in subclause 6.2;
3. when operating in systems that support MBMS functionality, provide the MBMS interface as described in subclause 4.2.2 and support the related MBMS subchannel control procedure as specified in subclause 10.3;

4. provide PTT button events towards the on-network floor participant as specified in subclause 6.2;
5. provide means (sound, display, etc.) for indications towards the MCPTT user as specified in subclause 6.2;
6. support negotiating media plane control channel media level attributes as specified in subclause 4.3; and
7. support call setup control over pre-established session as specified in subclause 9.2.

To be compliant with the off-network procedures in this document, an MCPTT client shall:

1. provide the role of a floor participant in off-network mode as specified in subclause 5.2.3;
2. support the role of an off-network floor participant as specified in 3GPP TS 23.179 [5] and in the present specification;
3. provide the media mixer function as described in subclause 4.2.2 and support the related procedures as specified in clause 7;
4. provide PTT button events towards the off-network floor participant as specified in clause 7; and
5. provide means (sound, display, etc.) for indications towards the MCPTT user as specified in clause 7.

5.2.2 Floor participant in on-network mode

To be compliant with the on-network procedures in this document, a floor participant in on-network mode shall:

1. support the on-network floor control procedures as defined in 3GPP TS 23.179 [5];
2. support acting as an on-network floor participant as specified in subclause 6.2; and
3. support the on-network mode floor control protocol elements as specified in the clause 8.

A floor participant in on-network mode may:

1. support queueing of floor requests as specified in subclause 6.2 and subclause 4.1.1.2.

5.2.3 Floor participant in off-network mode

To be compliant with the on-network procedures in this document, a floor participant in off-network mode shall:

1. support off-network floor control procedures as specified in 3GPP TS 23.179 [5];
2. support acting as an off-network floor participant as specified in clause 7;
3. support acting as an off-network floor control server as specified in clause 7; and
4. support the off-network mode floor control protocol elements in clause 8.

A floor participant in off-network mode may:

1. support queueing of floor requests as specified in clause 7 and subclause 4.1.1.3.

5.3 Controlling MCPTT function

An MCPTT server providing the controlling MCPTT function shall:

1. support the role of a controlling MCPTT function as specified in 3GPP TS 23.179 [5];
2. support negotiating media plane control channel media level attributes as specified in subclause 4.3;
3. provide floor control arbitration logic with an interface to MCPTT clients as described in subclause 4.2.1 and support the related procedures as specified in subclause 6.3;
4. provided a network media interface as described in subclause 4.2.1 and support associated procedures as specified in subclause 6.3;

5. provide a media distributor with an floor control interface towards the MCPTT clients as described in subclause 4.2.1 and support associated procedures in subclause 6.3;

6. support the on-network mode floor control protocol elements as specified in clause 8: and

7. support media plane security as specified in clause 13.

An MCPTT server providing the controlling MCPTT function may:

1. provide a floor request queue as described in subclause 4.2.1 and support the related procedures as specified in subclause 6.3 and subclause 4.3.

5.4 Participating MCPTT function

An MCPTT server providing the participating MCPTT function shall:

1. support the role of a participating MCPTT function as specified in 3GPP TS 23.179 [5];

2. distribute floor control messages as described in subclause 6.3 and support associated procedures as specified in subclause 6.4;

3. support call setup control over pre-established session as specified in subclause 9.3;

4. when operating in systems that support MBMS functionality, provide MBMS bearer management as specified in subclause 6.4 and the related MBMS subchannel control procedures as specified in subclause 10.2; and

5. support media plane security as specified in clause 13.

5.5 Non-controlling MCPTT function

An MCPTT server providing the non-controlling MCPTT function of an MCPTT group shall:

1. support floor control involving groups from multiple MCPTT systems as specified in 3GPP TS 24.379 [2];

2. provide a floor control interface towards the controlling MCPTT function as described in subclause 4.2.4 and support the related procedures as specified in subclause 6.5;

3. provide an media interface towards the controlling MCPTT function as described in subclause 4.2.4 and support the related procedure as specified in subclause 6.5;

4. provide a media distributor as described in subclause 4.2.4 and the related procedures as specified in subclause 6.5; and

5. support media plane security as specified in clause 13.

6 On-network floor control

6.1 General

This clause provides:

1. the floor participant procedures in subclause 6.2;

2. the floor control server procedures in subclause 6.3;

3. the participating MCPTT function floor control procedures in subclause 6.4; and

4. the non-controlling MCPTT function of an MCPTT group in subclause 6.5.

If media plane security is required, the MCPTT client, the controlling MCPTT function, the participating MCPTT function and the non-controlling MCPTT function shall perform the additionally procedures in clause 13.

6.2 Floor participant procedures

6.2.1 Floor participant procedures at MCPTT session initialization

Based on the negotiations during the call establishment specified in 3GPP TS 24.379 [2], a new instance of the 'Floor participant state transition diagram for basic operation', as specified in subclause 6.2.4, shall be created for this call.

The SIP INVITE request sent by the application and signalling plane:

1. shall be regarded an implicit floor request when an implicit floor request is negotiated; and
2. shall not be regarded as an implicit floor request in case of a rejoin to an already on-going group call.

NOTE: The floor participant can negotiate the use of prioritization of the Floor Request message. In that case, the floor participant can request permission to send media at a priority level that is either the same as or lower than the highest priority that was permitted to the participant in the MCPTT call initialization. If a floor participant is authorized for pre-emptive priority in the MCPTT call it is good practise to always request permission to send RTP media packets at a priority level that is lower than pre-emptive priority unless the user explicitly requests to pre-empt the current RTP media packets sender.

6.2.2 Floor participant procedures at MCPTT call release

The MCPTT call release (whether it is initiated by the floor participant or floor control server) is a two-step procedure.

Step 1 The floor participant stops sending floor control messages and the MCPTT client stops sending RTP media packets.

Step 2 When the application and signalling plane has determined that the MCPTT call is released, the corresponding instance of the 'Floor participant state transition diagram for basic operation' as specified in subclause 6.2.4 is terminated and the floor participant releases all the used resources.

The user plane can initiate the release step 1, but the application and signalling plane always initiates the release step 2.

6.2.3 Floor participant procedures at MCPTT call modification

Adding or removing media streams during an MCPTT call does not influence the floor control procedures.

6.2.4 Floor participant state transition diagram for basic operation

6.2.4.1 General

The floor participant shall behave according to the state diagram and the state transitions specified in this subclause.

Figure 6.2.4.1-1 shows the state diagram for 'Floor participant state transition diagram for basic operation'.

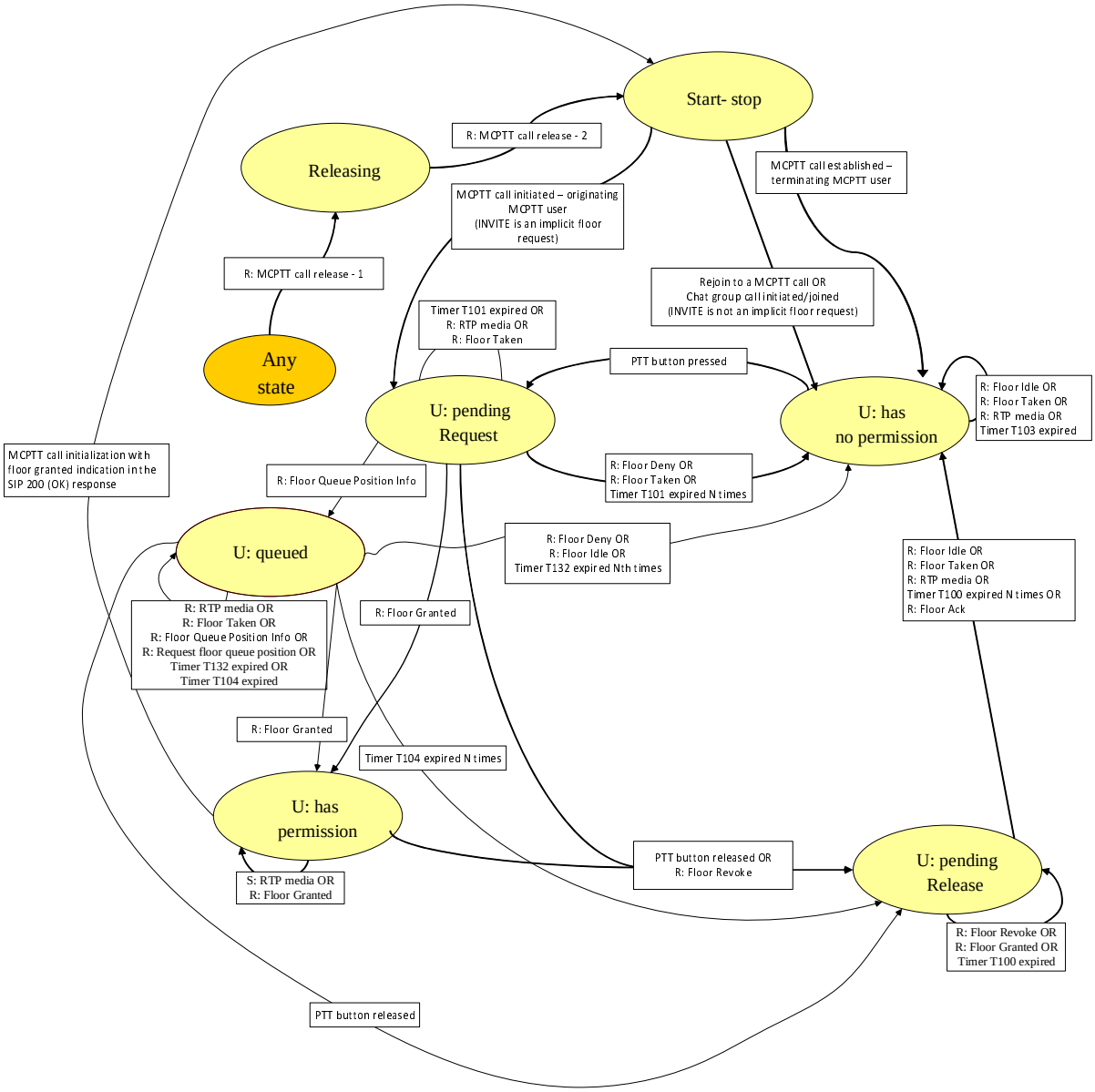


Figure 6.2.4.1-1: Floor participant state transition diagram for basic operation.

State details are explained in the following subclauses.

If an RTP media packet or a floor control message arrives in a state where there is no specific procedure specified for the RTP media packets or the received floor control message, the floor participant shall discard the floor control message or the RTP media packet and shall remain in the current state.

NOTE: A badly formatted RTP packet or floor control message received in any state is ignored by the floor participant and does not cause any change of the current state.

6.2.4.2 State: 'Start-stop'

6.2.4.2.1 General

When a new instance of the 'Floor participant state transition diagram for basic operation' is initiated, before any floor control related input is applied, the state machine is in 'Start-stop' state. Similarly when the call is released the state machine shall return to the Start-Stop state.

6.2.4.2.2 MCPTT call initiated – originating MCPTT user

When a call is initiated as described in 3GPP TS 24.379 [2], the floor participant:

1. shall create an instance of the 'Floor participant state transition diagram for basic operation';
2. if the originating floor participant receives a floor control message before it receives the SIP 200 (OK) response, shall store the floor control message;

NOTE: The originating floor participant might receive a floor control message before the SIP 200 (OK) response when initiating, joining or rejoining a call because of processing delays of the SIP 200 (OK) response in the SIP core.

3. if the established MCPTT call is a chat group call, shall enter the 'U: has no permission' state; and
4. if the established MCPTT call is not a chat group call:
   a. shall start timer T101 (Floor Request) and initialise counter C101 (Floor Request) to 1;
   b. shall enter the 'U: pending Request' state; and
   c. if the floor participant has received and stored a floor control message before the reception of the SIP 200 (OK) response, shall act as if the floor control message was received in the 'U: pending Request' state after entering the 'U: pending Request' state.

When the floor participant is rejoining an ongoing MCPTT call as described in 3GPP TS 24.379 [2] the floor participant shall enter the 'U: has no permission state'.

6.2.4.2.3 MCPTT call established, terminating MCPTT user

When an MCPTT call is established, the terminating floor participant:

1. shall create an instance of a 'Floor participant state transition diagram for basic operation'; and
2. shall enter the 'U: has no permission' state.

NOTE: From a floor participant perspective the MCPTT call is established when the application and signalling plane sends the SIP 200 (OK) response.

6.2.4.3 State: 'U: has no permission'

6.2.4.3.1 General

The floor participant is in this state when the floor participant is not sending RTP media packets or is not waiting for a floor control message response.

In this state RTP media packets and floor control messages can be received.

6.2.4.3.2 Receive Floor Idle message (R: Floor Idle)

Upon receiving a Floor Idle message, the participant:

1. if the first bit in the subtype of the Floor Idle message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:

a. shall include the Message Type field set to '5' (Floor Idle); and

b. shall include the Source field set to '0' (the floor participant is the source);

2. may provide floor idle notification to the user, if it has not already done so;

3. shall stop the optional timer T103 (end of RTP media), if it is running; and

4. shall remain in the 'U: has no permission' state.

6.2.4.3.3 Receive Floor Taken message (R: Floor Taken)

Upon receiving the Floor Taken message, the floor participant:

1. if the first bit in the subtype of the Floor Taken message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:

   a. shall include the Message Type field set to '2' (Floor Taken); and

   b. shall include the Source field set to '0' (the floor participant is the source);

2. may provide a floor taken notification to the user;

3. if the Floor Indicator field is included and the B-bit is set to '1' (Broadcast group call), shall provide a notification to the user indicating the type of call;

4. should start the optional timer T103 (end of RTP media); and

5. shall remain in the 'U: has no permission' state.

6.2.4.3.4 Receive RTP media packets (R: RTP media)

Upon receiving RTP media packets, the floor participant:

1. shall request the MCPTT client to start rendering the received RTP media packets;

2. should restart/start the optional timer T103 (end of RTP media); and

3. shall remain in the 'U: has no permission' state.

NOTE: RTP media packets can be received from two sources when dual floor control is applied by the floor control server (see subclause 6.3.6). The MCPTT client can differentiate between the two sources using the SSRC in the received RTP media packets. How the media mixer in the MCPTT client mixes the two RTP media stream sources is out of scope of the present document.

6.2.4.3.5 Send Floor Request message (PTT pressed)

Upon receiving an indication from the user to request permission to send media, the floor participant:

1. shall send the Floor Request message toward the floor control server; The Floor Request message:

   a. if a different priority than the normal priority is required, shall include the Floor Priority field with the priority not higher than negotiated with the floor control server as specified in subclause 4.3.3; and

   b. if the floor request is a broadcast group call, system call, emergency call or an imminent peril call, shall include a Floor Indicator field indicating the relevant call types;

2. shall start timer T101 (Floor Request) and initialise counter C101 (Floor Request) to 1; and

3. shall enter the 'U: pending Request' state.

6.2.4.3.6 Timer T103 (end of RTP media) expired

On expiry of timer T103 (end of RTP media), the floor participant:

1. may provide a floor idle notification to the user; and
2. shall remain in the 'U: has no permission' state.

6.2.4.4 State: 'U: pending Request'

6.2.4.4.1 General

The floor participant is in this state when the floor participant is waiting for response to a Floor Request message.

In this state the floor participant can receive RTP media packets and floor control messages.

Timer T101 (Floor Request) is running in this state.

Timer T103 (end of RTP media) can be running in this state but there is no action in this state if the timer expires. The timer is started as a preparation for the state change that occurs once a response to the Floor Request message is received.

6.2.4.4.2 Receive Floor Granted message (R: Floor Granted)

Upon receiving a Floor Granted message from the floor control server or a floor granted indication in an SIP 200 (OK) response in the application and signalling layer, the floor participant:

1. if the first bit in the subtype of the Floor Granted message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:
   a. shall include the Message Type field set to '1' (Floor Granted); and
   b. shall include the Source field set to '0' (the floor participant is the source);
2. shall provide floor granted notification to the user, if not already done;

NOTE: Providing the floor granted notification to the user prior to receiving the Floor Granted message is an implementation option.

3. if the Floor Indicator field is included and the B-bit is set to '1' (Broadcast group call), shall provide a notification to the user indicating the type of call;
4. shall stop the optional timer T103 (end of RTP media), if running;
5. shall stop timer T101 (Floor Request); and
6. shall enter the 'U: has permission' state.

6.2.4.4.3 Receive Floor Taken message (R: Floor Taken)

Upon receiving a Floor Taken message, the floor participant:

1. if the first bit in the subtype of the Floor Taken message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:
   a. shall include the Message Type field set to '2' (Floor Taken);
   b. shall include the Source field set to '0' (the floor participant is the source);
2. if the Granted Party's Identity field contains another MCPTT ID than the MCPTT user's own MCPTT ID, shall not continue with the rest of the steps;

NOTE: When received over the MBMS bearer it can be the result of the own MCPTT user being granted the floor or another MCPTT user being granted the floor. The floor participant only acts on the latter case.

3. shall provide a floor taken notification to the user;
4. if the Floor Indicator field is included and the B-bit is set to '1' (Broadcast group call), shall provide a notification to the user indicating the type of call;

5. if queueing is not negotiated as specified in subclause 4.3:
   a. shall stop timer T101 (Floor Request);
   b. should start the optional timer T103 (end of RTP media); and
   c. shall enter the 'U: has no permission' state; and
6. if queueing is negotiated as specified in subclause 4.3:
   a. shall remain in the 'U: pending Request' state.

6.2.4.4.4 Receive Floor Deny message (R: Floor Deny)

Upon receiving a Floor Deny message, the floor participant:

1. if the first bit in the subtype of the Floor Deny message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:
   a. shall include the Message Type field set to '3' (Floor Deny); and
   b. shall include the Source field set to '0' (the floor participant is the source);
2. shall provide floor deny notification to the user;
3. may display the floor deny reason to the user using information in the Reject Cause field;
4. shall stop timer T101 (Floor Request); and
5. shall enter the 'U: has no permission' state.

6.2.4.4.5 Timer T101 (Floor request) expired

On expiry of timer T101 (Floor Request) less than the upper limit of counter C101 (Floor Request) times the timer is allowed to expire, the floor participant:

1. shall send a Floor Request message towards the floor control server. The Floor Request message:
   a. if a different priority than the normal priority is required, shall include the Priority-level field with a <Priority-level> value not higher than negotiated with the floor control server as specified in subclause 4.3.3; and
   b. if the floor request is a broadcast group call, system call, emergency call or an imminent peril call, shall include a Floor Indicator field indicating the relevant call types;
2. shall restart timer T101 (Floor request) and increment counter C101 (Floor Request) by 1; and
3. shall remain in the 'U: pending Request' state.

6.2.4.4.6 Timer T101 (Floor Request) expired N times

When timer T101 (Floor Request) expires by the upper limit of counter C101 (Floor Request), the floor participant:

1. shall provide a floor request timeout notification to the user; and
2. shall enter the 'U: has no permission' state.

6.2.4.4.7 Receive RTP media packets (R: RTP Media)

Upon receiving RTP media packets, the floor participant:

1. shall request the MCPTT client to start rendering the received RTP media packets;
2. should start the optional timer T103 (end of RTP media); and
3. shall remain in the 'U: pending Request' state.

6.2.4.4.8 Send Floor Release message (PTT released)

Upon receiving an indication from the user to release permission to send media, the floor participant:

1. shall send a Floor Release message towards the floor control server;

   a. if the session is a broadcast call and if the session was established as a normal call, shall include the Floor Indicator with the A-bit set to '1' (Normal call);

2. may include the first bit in the subtype of the Floor Release message set to '1' (Acknowledgment is required) as described in subclause 8.3.2;

NOTE: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

3. shall start timer T100 (Floor Release) and initialise counter C100 (Floor Release) to 1;

4. shall stop timer T101 (Floor Request); and

5. shall enter the 'U: pending Release' state.

6.2.4.4.9 Receive Floor Queue Position Info message (R: Floor Queue Position Info)

Upon receiving a Floor Queue Position Info message, the floor participant:

1. if the first bit in the subtype of the Floor Queue Position Info message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:

   a. shall include the Message Type field set to '9' (Floor Queue Position Info); and

   b. shall include the Source field set to '0' (the floor participant is the source);

2. shall provide floor request queued response notification to the MCPTT user;

3. may provide the queue position and priority to the MCPTT user;

4. shall stop timer T104 (Floor Queue Position Request) if it is running; and

5. shall enter the 'U: queued' state.

6.2.4.5 State: 'U: has permission'

6.2.4.5.1 General

The floor participant is in this state when the MCPTT client is permitted to send RTP media. In this state the floor participant can receive floor control messages.

In this state, the floor participant can release permission to send RTP media at any time, even before sending any media.

The MCPTT client could have already buffered media when it enters this state.

NOTE: If the floor participant was queued, the floor participant requests a confirmation from the MCPTT user before start sending media. If confirmed, the media sending starts otherwise the permission to send media is released.

6.2.4.5.2 Send RTP media packets (RTP media in the buffer)

Upon receiving indication from the MCPTT client that encoded voice is received from the user or if encoded voice is already buffered the floor participant:

1. shall request the MCPTT client to start forward encoded voice to the MCPTT server; and

2. shall remain in the 'U: has permission' state.

6.2.4.5.3 Send Floor Release message (PTT released)

Upon receiving an indication from the user to release the permission to send RTP media, the floor participant:

1. shall send a Floor Release message towards the floor control server The Floor Release message:

   a. if the used floor priority is pre-emptive such that the floor control server allowed the MCPTT client to transmit media without revoking a current speaker, shall set the first bit in the subtype of the Floor Release message to '1' (acknowledgement is required) as specified in subclause 8.2.2; and

NOTE: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

   b. if the session is a broadcast call and if the session was established as a normal call, shall include the Floor Indicator with the A-bit set to '1' (Normal call);

3. shall start timer T100 (Floor Release) and initialize counter C100 (Floor Release) to 1; and

4. shall enter the 'U: pending Release' state.

6.2.4.5.4 Receive Floor Revoke message (R: Floor Revoke)

Upon receiving a Floor Revoke message, the floor participant:

1. shall inform the user that the permission to send RTP media is being revoked;

2. may give information to the user about the reason for revoking the permission to send media;

3. shall request the media in the MCPTT client discard any remaining buffered RTP media packets and to stop forwarding of encoded voice to the MCPTT server;

4. should send a Floor Release message as specified in subclause 6.2.4.7.5;

5. may set the first bit in the subtype of the Floor Revoke message to '1' (Acknowledgment is required) as described in subclause 8.3.2;

NOTE: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

6. shall start timer T100 (Floor Release) and initialize counter C100 (Floor Release) to 1; and

7. shall enter the 'U: pending Release' state.

6.2.4.5.5 Receive Floor Granted message (R: Floor Granted)

Upon receiving a Floor Granted message from the floor control server, the floor participant:

1. if the first bit in the subtype of the Floor Granted message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:

   a. shall include the Message Type field set to '1' (Floor Granted); and

   b. shall include the Source field set to '0' (the floor participant is the source); and

2. shall remain in the 'U: has permission' state.

6.2.4.6 State: 'U: pending Release'

6.2.4.6.1 General

The floor participant is in this state when the floor participant is waiting for response to a Floor Release message.

In this state the floor participant can receive floor control messages and RTP media packets.

Timer T100 (Floor Release) is running can be running in this state.

6.2.4.6.2 Timer T100 (Floor Release) expired

On expiry of timer T100 (Floor Release) less than the configurable number of the upper limit of counter C100 (Floor Release) times, the floor participant:

1. shall send a Floor Release message towards the floor control server;
2. may set the first bit in the subtype of the Floor Release message to '1' (Acknowledgment is required) as described in subclause 8.3.2;

NOTE: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

3. shall restart timer T100 (Floor Release) and increment counter C100 (Floor Release) by 1; and
4. shall remain in state 'U: pending Release'.

6.2.4.6.3 Timer T100 (Floor release) expired N times

When timer T100 (Floor Release) expires by the upper limit of counter C100 (Floor Release) times, the floor participant:

1. shall enter the 'U: has no permission' state.

6.2.4.6.4 Receive Floor Idle message (R: Floor Idle)

Upon receiving a Floor Idle message, the floor participant:

1. if the first bit in the subtype of the Floor Idle message to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:
   a. shall include the Message Type field set to '5' (Floor Idle); and
   b. shall include the Source field set to '0' (the floor participant is the source);
2. may provide a floor idle notification to the MCPTT user;
3. if the Floor Indicator field is included and the B-bit set to '1' (Broadcast group call), shall provide a notification to the user indicating the type of call;
4. shall stop timer T100 (Floor Release);
5. if the session is not a broadcast group call or if the A-bit in the Floor Indicator field is set to '1' (Normal call), shall enter the 'U: has no permission' state; and
6. if the session was initiated as a broadcast group call:
   a. shall indicate to the MCPTT client the media transmission is completed; and
   b shall enter the 'Releasing' state.

6.2.4.6.5 Receive Floor Taken message (R: Floor Taken)

Upon receiving a Floor Taken message, the floor participant:

1. if the first bit in the subtype of the Floor Taken message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:
   a. shall include the Message Type field set to '2' (Floor Taken); and
   b. shall include the Source field set to '0' (the floor participant is the source);
2. may provide floor taken notification to the user;
3. if the Floor Indicator field is included and the B-bit is set to '1' (Broadcast group call), shall provide a notification to the user indicating the type of call;

4. should start the optional timer T103 (end of RTP media);
5. shall stop timer T100 (Floor Release); and
6. shall enter the 'U: has no permission' state.

6.2.4.6.6 Receive RTP media packets (R: RTP Media)

Upon receiving an indication from the MCPTT client that RTP media packets are received, the floor participant:

1. shall request the MCPTT client to start rendering the RTP media packets;
2. should start the optional timer T103 (end of RTP media);
3. shall stop timer T100 (Floor Release); and
4. shall enter the 'U: has no permission' state.

Upon receiving a Floor Revoke message, the floor participant:

1. can give information to the user that permission to send RTP media is being revoked, if a retry after time is contained in the Floor Revoke message;
2. may inform the user of the reason contained in the Reject Cause field; and
3. shall remain in the 'U: pending Release' state.

6.2.4.6.7 Receive Floor Revoke message (R: Floor Revoke)

Upon receiving a Floor Revoke message, the floor participant:

1. may give information to the user that permission to send RTP media is being revoked, if a retry after time is contained in the Floor Revoke message;
2. may inform the user of the reason contained in the Floor Revoke message; and
3. shall remain in the 'U: pending Release' state.

6.2.4.6.8 Receive Floor Granted message (R: Floor Granted)

Upon receiving a Floor Granted message, the floor participant:

1. if the first bit in the subtype of the Floor Granted message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:
   a. shall include the Message Type field set to '1' (Floor Granted); and
   b. shall include the Source field set to '0' (the floor participant is the source); and
2. shall remain in the 'U: pending Release' state.

6.2.4.6.9 Receive Floor Ack message (R: Floor Ack)

Upon receiving a Floor Ack message, the floor participant:

1. may provide floor taken notification to the user;
2. shall stop timer T100 (Floor Release); and
3. shall enter the 'U: has no permission' state.

6.2.4.8 In any state

6.2.4.8.1 General

This subclause describes the actions to be taken in all states defined for the basic state diagram with the exception of the 'Start-stop' state and the 'Releasing' state.

6.2.4.8.2 Receive MCPTT call release – step 1 (R: MCPTT call release - 1)

Upon receiving an MCPTT call release step 1 request from the application and signalling plane when the MCPTT call is going to be released or when the floor participant is leaving the MCPTT call, the floor participant:

1. shall stop sending floor control messages;
2. shall request the MCPTT client to stop sending RTP media packets; and
3. shall enter the 'Releasing' state.

6.2.4.9 State: 'Releasing'

6.2.4.9.1 General

The floor participant is in this state while waiting for the application and signalling plane to finalize the disconnection of an MCPTT call.

6.2.4.9.2 Receive MCPTT call release – step 2 (R: MCPTT call release - 2)

Upon receiving an MCPTT call release step 2 request from the application and signalling, the floor participant:

1. shall release all resources including any running timers associated with the MCPTT call; and
2. shall enter the 'Start-stop' state and terminate the current instance of the 'Floor control state machine – basic'.

6.2.4.10 State: 'U: queued'

6.2.4.10..1 General

The floor participant uses this state when a Floor Request message has been queued by the floor control server, and is awaiting the Floor Granted message.

In this state, the MCPTT client can receive RTP Media packets and the floor participant can send and receive floor control messages.

The timer T104 (Floor Queue Position Request) can be running in this state.

6.2.4.10.2 Receive RTP media packets (R: Media)

Upon receiving an indication from the media mixer in the MCPTT client that the media mixer is receiving RTP media packets, the floor participant:

1. shall request to the media mixer to start rendering received RTP media packets;
2. should restart timer T103 (end of RTP Media); and
3. shall remain in the 'U: queued' state.

NOTE: RTP media packets can be received from two sources when dual floor control is applied by the floor control server (see subclause 6.3.6). The MCPTT client can differentiate between the two sources using the SSRC in the received RTP media packets. How the media mixer in the MCPTT client mixes the two RTP media stream sources is out of scope of the present document.

6.2.4.10.3 Receive Floor Taken message (R: Floor Taken)

Upon receiving a Floor Taken message, the floor participant:

1. may provide a floor taken notification to the MCPTT user;
2. if the first bit in the subtype of the Floor Taken message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:
   a. shall include the Message Type field set to '2' (Floor Taken); and
   b. shall include the Source field set to '0' (the floor participant is the source); and
3. shall remain in the 'U: queued' state.

6.2.4.10.4 Receive Floor Granted message (R: Floor Granted)

Upon receiving a Floor Granted message, the floor participant:

1. if the first bit in the subtype of the Floor Granted message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:
   a. shall include the Message Type field set to '1' (Floor Granted); and
   b. shall include the Source field set to '0' (the floor participant is the source);
2. shall provide a floor granted notification to the MCPTT user;
3. if the Floor Indicator field is included and the B-bit is set to '1' (Broadcast group call), shall provide a notification to the user indicating the type of call;
4. shall stop timer T104 (Floor Queue Position Request), if running;
5. shall start timer T132 (Queued request granted user action);
6. shall indicate the user that the floor is granted; and
7. shall remain in the 'U: queued' state.

6.2.4.10.5 Receive Floor Deny message (R: Floor Deny)

Upon receiving a Floor Deny message, the floor participant:

1. if the first bit in the subtype of the Floor Deny message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:
   a. shall include the Message Type field set to '3' (Floor Deny); and
   b. shall include the Source field set to '0' (the floor participant is the source);
2. shall provide floor deny notification to the MCPTT user;
3. may display the deny reason to the user using information in the Reject Cause field;
4. shall stop timer T104 (Floor Queue Position Request), if running; and
5. shall enter the 'U: has no permission' state.

6.2.4.10.6 Send Floor Release message (PTT button released)

Upon receiving an indication from the MCPTT user to release the queued floor request, the floor participant:

1. shall send a Floor Release message: The Floor Release message:
   a. may include the Floor Indicator field changing a broadcast group call to a normal call;

2. may set the first bit in the subtype of the Floor Release message to '1' (Acknowledgment is required) as described in subclause 8.3.2;

NOTE: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

3. shall start timer T100 (Floor Release) and initialise counter C10 (Floor Release) to 1;

4. shall stop timer T104 (Floor Queue Position Request), if running; and

5. shall enter the 'U: pending Release state.

6.2.4.10.7 Receive Floor Queue Position Info message (R: Floor Queue Position Info)

Upon receiving a Floor Queue Position Info message, the floor participant:

1. if the first bit in the subtype of the Floor Queue Position Info message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:

   a. shall include the Message Type field set to '9' (Floor Queue Position Info); and

   b. shall include the Source field set to '0' (the floor participant is the source);

2. if the message indicates that the request has been queued or if a request for the queue position was sent, the floor participant:

   a. may provide the queue position and priority (if available) to the MCPTT user;

3. shall stop the timer T104 (Floor Queue Position Request), if running; and

4. shall remain in the 'U: queued' state.

6.2.4.10.8 Receive Floor Idle message (R: Floor Idle)

Upon receiving a Floor Idle message, the floor participant:

1. if the first bit in the subtype of the Floor Idle message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:

   a. shall include the Message Type field set to '5' (Floor Idle); and

   b. shall include the Source field set to '0' (the floor participant is the source); and

2. shall enter the 'U: has no permission' state.

6.2.4.10.9 Send Floor Queue Position Request message (R: Floor Queue Position Request)

Upon receipt of an indication from the MCPTT client to request the queue position, the floor participant:

1. shall send the Floor Queue Position Request message;

2. shall start timer T104 (Floor Queue Position Request) and initialize counter C104 (Floor Queue Position Request) to 1; and

3. remain in the 'U: queued' state.

6.2.4.10.10 Timer T104 (Floor Queue Position Request) expired

On expiry of timer T104 (Floor Queue Position Request) less than the upper limit of C104 (Floor Queue Position Request) times, the floor participant:

1. shall send a Floor Queue Position Request message towards the floor control server;

2. shall restart timer T104 (Floor Queue Position Request) and increment counter C104 (Floor Queue Position Request) by 1; and

3. shall remain in the 'U: queued' state.

6.2.4.10.11 Timer T104 (Floor Queue Position Request) expired N times

When timer T104 (Floor Queue Position Request) expires by the upper limit of counter C104 (Floor Queue Position Request) times, the floor participant:

1. shall provide a floor queued timeout to the MCPTT client;
2. send the Floor Release message;
3. may set the first bit in the subtype of the Floor Queue Position message to '1' (Acknowledgment is required) as described in subclause 8.3.2, and

NOTE: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

4. shall enter the 'U: pending Release state.

6.2.4.10.12 User indication for accept of pending request

Upon receiving an indication from the user that the user wants to send media and the timer T133 (pending user action) is running, the floor participant:

1. shall stop timer T132 (queued request granted user action); and
2. shall enter 'U: has permission' state.

6.2.4.10.13 Timer T132 (queued granted user action) expires

Upon expiry of timer T132 (queued granted user action) the floor participant:

1. shall send Floor Release message;
2. may indicate the user that the floor is no more available;
3. may set the first bit in the subtype of the Floor Release message to '1' (Acknowledgment is required) as described in subclause 8.3.2; and

NOTE: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

4. shall enter 'U: has no permission' state.

6.3 Floor control server procedures

6.3.1 General

The floor control server arbitration logic in the floor control server shall support the procedures in subclauses 6.3.2 and 6.3.3 and shall behave according to the floor control server state transition diagram for 'general floor control operation' in subclause 6.3.4.

The floor control interface towards the MCPTT client in the floor control server shall behave according to the floor control server state transition diagram for 'basic floor control operation towards the floor participant' as specified in subclause 6.3.5.

6.3.2 Controlling MCPTT function procedures at MCPTT call initialization

6.3.2.1 General

The subclause 6.3.2.2 describes the initial procedures when a new SIP session is establishing a group session or a private session with floor control.

The subclause 6.3.2.3 describes the procedures when a non-controlling MCPTT function switches from the non-controlling mode to the controlling mode.

6.3.2.2 Initial procedures

When an MCPTT call is established a new instance of the floor control server state machine for 'general floor control operation' is created.

For each MCPTT client added to the MCPTT call, a new instance of the floor control server state machine for 'basic floor control operation towards the floor participant' is added.

If the optional "mc_queueing" feature is supported and has been negotiated as specified in clause 14, the floor control server could queue the implicit floor control request for the media-floor control entity.

The original initial SIP INVITE request or SIP REFER request to establish an MCPTT chat group call or to rejoin an ongoing MCPTT call is not handled as an implicit floor control request message by the floor control server unless explicitly stated in the SIP INVITE request or in the SIP REFER request.

The permission to send media to the invited MCPTT client due to implicit floor control request is applicable to both confirmed indication and unconfirmed indication.

When the first unconfirmed indication is received from the invited participating MCPTT function (see 3GPP TS 24.379 [2]) the floor control server optionally can give an early indication to send RTP media packets, to the inviting MCPTT client.

If an early indication to send RTP media packets is given to the inviting MCPTT client, the floor participant is granted the permission to send media and the MCPTT server buffers RTP media packets received from the MCPTT client at least until the first invited MCPTT client accepts the invitation or until the RTP media packet buffer exceeds it maximum limit to store RTP media packets.

If the MCPTT server does not support or does not allow media buffering then when an early indication to send RTP media packets is not given to the inviting MCPTT client, the floor participant is granted the permission to send media when the first invited MCPTT client accepts the media.

Before the floor control server sends the first floor control message in the MCPTT call, the floor control server has to assign itself a SSRC identifier to be included in media floor control messages and quality feedback messages if the MCPTT server is supporting that option. A suitable algorithm to generate the SSRC identifier is described in IETF RFC 3550 [3].

The floor participant and the floor control server can negotiate the maximum priority level that the floor participant is permitted to request. The floor control server can pre-empt the current sender based on the negotiated maximum priority level that the floor participant is permitted to request and the priority level included in the Floor Request message.

NOTE: The maximum priority level that a floor participant can use is negotiated as specified in subclause 4.3.3 and is based on group data retrieved by the controlling MCPTT function from the group management server as described in 3GPP TS 24.381 [12].

The floor participant and the floor control server can negotiate queueing of floor requests using the "mc_queueing" fmtp attribute as described in clause 14. If queueing is supported and negotiated, the floor control server queues the floor control request if a Floor Request message is received when another floor participant has the floor and the priority of the current speaker is the same or higher.

6.3.2.3 Switching from a non-controlling MCPTT function mode to a controlling MCPTT function mode

When the MCPTT server switches from the non-controlling MCPTT function mode to controlling MCPTT function mode a new instance of the floor control server state machine for 'general floor control operation' is created.

For each MCPTT client in the MCPTT call a new instance of the floor control server state machine for 'basic floor control operation towards the floor participant' is added.

Any floor request in the passive floor request queue is moved to the active floor request queue.

NOTE: The passive floor request queue is a floor request queue used by the non-controlling MCPTT function as specified in subclause 6.5.4 to monitor floor request sent by floor participants controlled by the non-controlling MCPTT function.

6.3.3 MCPTT floor control procedures at MCPTT call release

When an MCPTT client leaves an MCPTT call and the MCPTT call remains ongoing with the other MCPTT clients, the floor control server follows a two-step procedure.

Step 1 The MCPTT server stops sending floor control messages and RTP media packets to the MCPTT client leaving the MCPTT call and .the MCPTT server discards floor control messages and RTP media packets received from the MCPTT client leaving the MCPTT call.

Step 2 When the application and signalling plane has determined that the MCPTT call with this floor participant has been released, the corresponding instance of the floor control server state machine for 'basic floor control operation towards the floor participant' is released.

When an MCPTT call is released, the floor control server follows a two-step procedure.

Step 1 The MCPTT server stops sending floor control messages and RTP media packets to all floor participants in the MCPTT call.

Step 2 When the application and signalling plane has determined that the MCPTT call has been released, the corresponding instance of the floor control server state machine for 'general floor control operation' are also terminated, along with any 'basic floor control operation towards the floor participant' state machines for the floor participants of this call.

The floor control server state machine for general floor control operation initiates the MCPTT call release depending on the release policy specified in 3GPP TS 24.379 [2].

6.3.4 Floor control server state transition diagram for general floor control operation

6.3.4.1 General

The floor control server arbitration logic in the floor control server shall behave according to the state diagram and state transitions specified in this subclause.

Figure 6.3.4.1-1 shows the general floor control operation states (G states) and the state transition diagram.

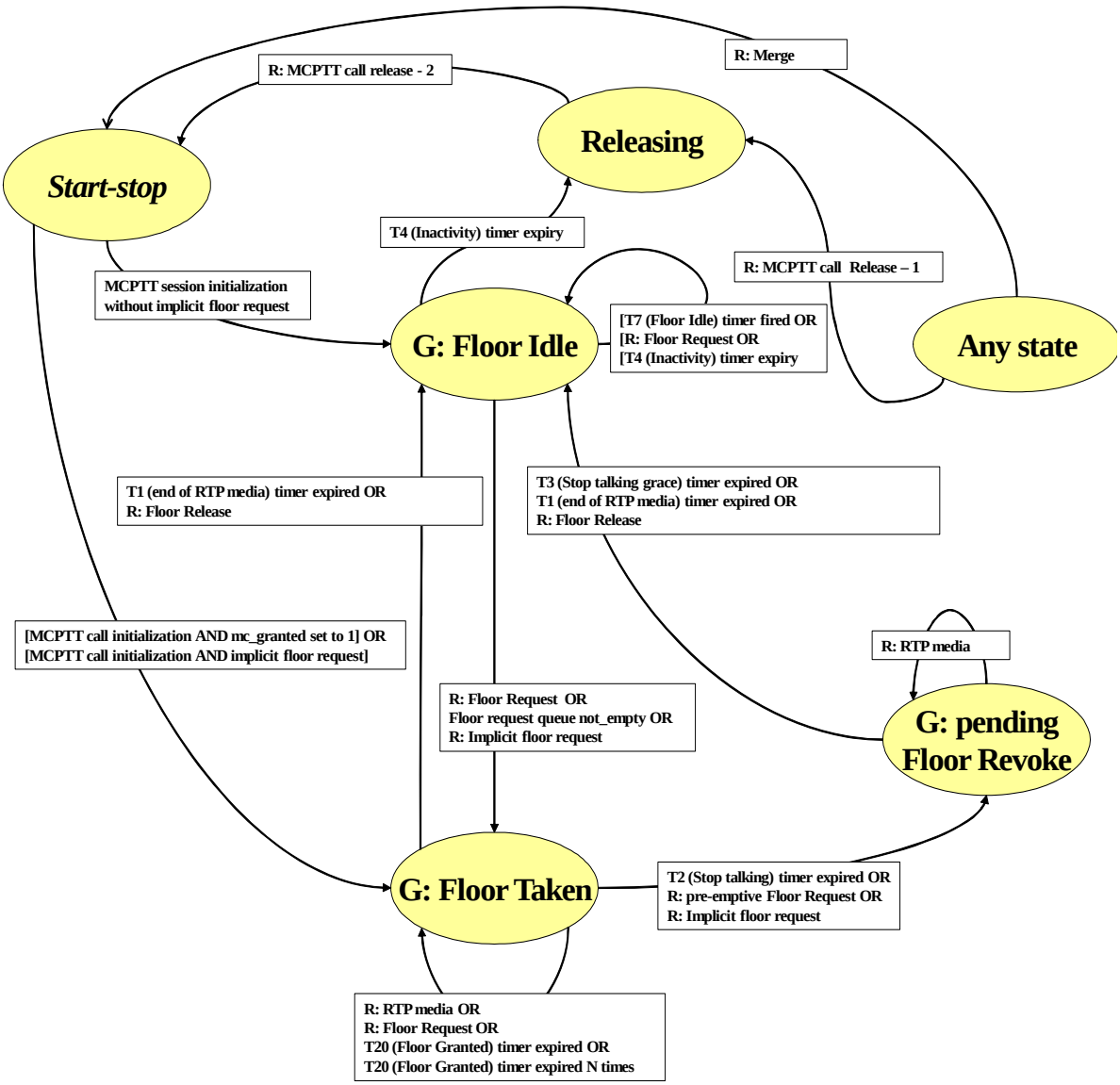


Figure 6.3.4.1-1: Floor control server state transition diagram for 'general floor control operation'

The floor control arbitration logic in the floor control server shall keep one instance of the 'general floor control operation' state machine per MCPTT call.

The floor participant associated to the 'general floor control operation' state is in the following subclauses referred to as the permitted MCPTT client.

If floor control messages or RTP media packets arrives in a state where there is no procedure specified in the following subclauses the floor control arbitration logic in the floor control server:

1. shall discard the floor control message;
2. shall request the media distributor in the MCPTT server to discard any received RTP media packet; and
3. shall remain in the current state.

State details are explained in the following subclauses.

6.3.4.2 State: 'Start-stop'

6.3.4.2.1 General

When a new instance of the 'general floor control operation' state machine is initiated, before any floor control related input is applied, the state machine is in 'Start-stop' state. Similarly when the call is released the state machine shall return to the 'Start-stop' state or the related MCPTT call is released.

6.3.4.2.2 MCPTT call initialization

When an MCPTT call is initiated as specified in 3GPP TS 24.379 [2] and

1. if an confirmed indication is required and at least one invited MCPTT client has accepted the invitation; or
2. if an confirmed indication is not required;

then the floor control arbitration logic in the floor control server:

1. shall create an instance of the 'general floor control operation' state machine;
2. shall wait for the 'basic floor control operation towards the floor participant' to be initialized before continuing the following steps; and
3. shall when the 'basic floor control operation towards the floor participant' state machine is initialized:
   a. act as a Floor Request message and perform the actions specified in subclause 6.3.4.3.3, if the "mc_granted" fmtp attribute is not included and if the floor control server is granting an implicit floor request at MCPTT call establishment;
   b. enter the state 'G: Floor Taken' as specified in the subclause 6.3.4.4.2, if the "mc_granted" fmtp attribute is negotiated as specified in clause 14; or
   c. enter state 'G: Floor Idle' as specified in the subclause 6.3.4.3.2.

6.3.4.3 State: 'G: Floor Idle'

6.3.4.3.1 General

The floor control arbitration logic in the floor control server is in this state when no MCPTT user currently has permission to send media.

Timer T4 (inactivity) and timer T7 (Floor Idle) can be running when the floor control arbitration logic in the floor control server is in this state.

6.3.4.3.2 Enter state 'G: Floor Idle'

When entering this state from any state except the 'Start-stop' state and if either no MCPTT client negotiated support of queueing floor requests as described in clause 14, the floor control arbitration logic in the floor control server:

1. if there is a Track Info field stored, shall remove the Track Info field from the storage;
2. if the active floor request queue is empty the floor control server:
   a. shall send Floor Idle message to all floor participants. The Floor Idle message:
      i. shall include a Message Sequence Number field with a Message Sequence Number value increased with 1;
   b. shall start timer T7 (Floor Idle) and initialise counter C7 (Floor Idle) to 1;
   c. shall start timer T4 (inactivity); and
   d. shall set the general state to 'G: Floor Idle' state; and

3. if the active floor request queue is not empty the floor control server:

   a. shall select a queued floor request from the top of the active floor request queue;

   b. shall remove that queued floor request from the active floor request queue;

   c. if the queued floor request includes a Track Info field, shall store the Track Info field; and

   d. shall enter the state 'G: Floor Taken' as specified in the subclause 6.3.4.4.2 with respect to that floor participant.

6.3.4.3.3 Receive Floor Request message (R: Floor Request)

Upon receiving a floor request message (from a floor participant that is permitted to make a floor request) the floor control arbitration logic in the floor control server:

1. shall reject the request if one of the following conditions is fulfilled:

   a. if there is only one MCPTT client in the MCPTT call; and

   b. if the negotiated maximum priority level that the floor participant is permitted to request is receive only;

NOTE: The maximum priority level that the floor participant is permitted to request is negotiated as specified in subclause 4.3.3.

2. if the floor request is rejected the floor control server:

   a. shall send the Floor Deny message, the Floor Deny message:

      i. shall include in the Reject Cause field with the <Reject Cause> value:

         A. cause #3 (Only one participant), if there is only one MCPTT client in the MCPTT call; or

         B. cause #5 (Receive only), if the negotiated maximum priority level that the floor participant is permitted to request is receive only;

      ii. may include an additional text string explaining the reason for rejecting the floor request in the <Reject Phrase> value of the Reject Cause field; and

      iii. if the Floor Request included a Track Info field, shall include the received Track Info field;

   b. shall remain in the 'G: Floor Idle' state; and

3. if the floor request is granted the floor control server:

   a. shall stop timer T4 (inactivity);

   b. shall stop timer T7 (Floor Idle);

   c. shall store the SSRC of floor participant granted the permission to send media until the floor is released associated to that floor request;

   d. if a Track Info field is included in the Floor Request message, shall store the received Track Info field, and

   e. shall enter the state 'G: Floor Taken' as specified in the subclause 6.3.4.4.2.

6.3.4.3.4 Timer T7 (Floor Idle) expired

On expiry of timer T7 (Floor Idle) the floor control arbitration logic in the floor control server:

1. shall restart timer T7 (Floor Idle) and increment counter C7 (Floor Idle) by 1 if counter C7 (Floor Idle) has not reached its upper limit;

2. shall send a Floor Idle message to all floor participants in the MCPTT call if counter C7 (Floor Idle) has not reached its upper limit. The Floor Idle message:

a. shall include a Message Sequence Number field with a <Message Sequence Number> value increased with 1; and

3. shall remain in the 'G: Floor Idle' state.

6.3.4.3.5 Timer T4 (inactivity) expired

On expiry of timer T4 (inactivity) the floor control arbitration logic in the floor control server based on a configurable service provider policy either:

1. shall indicate to the application and signalling plane that timer T4 (inactivity) has expired; and
2. if the application and signalling planes initiates MCPTT call release, shall enter the 'Releasing' state; or
3. if the application and signalling planes does not initiate MCPTT call release:
   a. should restart the T4 (inactivity) timer; and
   b. shall remain in the 'G: Floor Idle' state.

6.3.4.3.6 Receive an implicit floor request (R: Implicit floor request)

Upon receiving an implicit floor request due to an upgrade to an emergency group call, the floor control arbitration logic in the floor control server:

1. shall reject the request if there is only one MCPTT client in the MCPTT call;
2. if the floor request is rejected the floor control server:
   a. shall send the Floor Deny message. The Floor Deny message:
      i. shall include in the Reject Cause field the <Reject Cause> value cause #3 (Only one participant); and
      ii. may include in the Reject Cause field an additional text string explaining the reason for rejecting the floor request in the <Reject Phrase> value; and
   b. shall remain in the 'G: Floor Idle' state; and
3. if the floor request is granted the floor control server:
   a. shall stop the timer T4 (inactivity);
   b. shall stop the timer T7 (Floor Idle);
   c. shall store the SSRC of floor participant granted the permission to send media until the floor is released associated to that floor request; and
   d. shall enter the state 'G: Floor Taken' as specified in the subclause 6.3.4.4.2.

6.3.4.4 State: 'G: Floor Taken'

6.3.4.4.1 General

The floor control arbitration logic in the floor control server uses this state when it has permitted one of the MCPTT clients in the MCPTT call to send media.

Timer T1 (end of RTP media) can be running when the floor control server is in this state.

Timer T2 (stop talking) can be running when the floor control server is in this state.

Timer T20 (Floor Granted) is running to guarantee reliable delivery of the Floor Granted message, if the granted floor request was queued.

6.3.4.4.2 Enter state 'G: Floor Taken'

When entering this state the floor control arbitration logic in the floor control server:

1. shall send a Floor Granted message to the requesting floor participant. The Floor Granted message:
   a. shall include the value of timer T2 (Stop talking)in the Duration field;
   b. shall include the granted priority in the Floor priority field;
   c. if a Track Info field is stored, shall include the received Track Info field; and
   d. if a group call is a broadcast group call, system call, emergency call or an imminent peril call, shall include the Floor Indicator field with an applicable indication;
2. shall start timer T20 (Floor Granted) if the floor request was queued and initialise the counter C20 (Floor Granted) to 1;
3. shall send Floor Taken message to all other floor participants. The Floor Taken message:
   a. shall include the granted MCPTT users MCPTT ID in the Granted Party's Identity field, if privacy is not requested;
   b. shall include a Message Sequence Number field with a Message Sequence Number value increased with 1;
   c. if the session is a broadcast group call, shall include the Permission to Request the Floor field set to '0';
   d. if the session is not a broadcast group call, may include the Permission to Request the Floor field set to '1'; and
   e. if a group call is a broadcast group call, a system call, an emergency call or an imminent peril call, shall include the Floor Indicator field with an applicable indication;
4. shall start timer T1 (end of RTP media); and
5. shall enter the state to 'G: Floor Taken' state.

6.3.4.4.3 Timer T1 (end of RTP media) expired

On expiry of timer T1 (end of RTP media), the floor control arbitration logic in the floor control server:

1. shall stop the timer T2 (Stop talking); if running;
2. shall stop timer T20 (Granted re-send), if running;
3. shall request the media distributor in the MCPTT server to stop distributing RTP media packets (with the exception of RTP media packets already in the buffer (if RTP media buffering is ongoing) to other MCPTT client, and
4. shall enter the state 'G: Floor Idle' as specified in the subclause 6.3.4.3.2.

6.3.4.4.4 Timer T2 (stop talking) expired

On expiry of timer T2 (stop talking) the floor control arbitration logic in the floor control server:

1. shall stop timer T1 (end of RTP media);
2. shall include the Reject Cause field with the <Reject Cause> value set to #2 (Media burst too long) in the Floor Revoke message sent in subclause 6.3.4.5.2; and
3. shall enter the 'G: pending Floor Revoke' state as specified in the subclause 6.3.4.5.2.

6.3.4.4.5 Receive RTP media packets (R: Media)

Upon receiving an indication from the media distributor in the MCPTT server that RTP media packets are received from the permitted MCPTT client, the floor control arbitration logic in the floor control server:

1. shall start timer T2 (stop talking), if running;
2. shall restart timer T1 (End of RTP media);
3. shall stop timer T20 (Floor Granted), if running;
4. shall instruct the media distributor to forward the RTP media packets to MCPTT clients according to local policy; and

NOTE: If dual floor control is ongoing as described in subclause 6.3.6, the list of floor participants that receive the overriding, overridden, or both transmissions is based on configuration.

5. shall remain in the 'G: Floor Taken' state.

6.3.4.4.6 Receive Floor Release message (R: Floor Release)

Upon receiving a Floor Release message the floor control arbitration logic in the floor control server:

1. shall request the media distributor in the MCPTT server to stop forwarding RTP media packets;
2. shall stop timer T2 (stop talking), if running;
3. shall stop timer T20 (Granted re-send), if running; and
4. enter state 'G: Floor Idle' as specified in the subclause 6.3.4.3.2.

6.3.4.4.7 Receive Floor Request message with pre-emptive priority (R: pre-emptive Floor Request)

NOTE: This procedure is also invoked from the subclause 6.3.5.4.4.

If the floor participant negotiated floor priority in the "mc_priority" fmtp attribute as specified in clause 14, on receipt of a floor request message with the request priority level equal to pre-emptive priority, and if the floor priority of the floor participant with permission to send media is not the pre-emptive floor priority, the floor control arbitration logic in the floor control server:

1. based on local policy, select one of the following options:
   a. revoke the current speaker; or
   b. allow media from both the current speaker and from the participant now requesting floor with a pre-emptive floor priority;
2. if revoking current speaker is selected:
   a. shall stop timer T1 (end of RTP media), if running;
   b. shall stop timer T20 (Floor Granted), if running;
   c. shall include a Reject Cause field with the <Reject Cause> value set to #4 (Media Burst pre-empted) in the Floor Revoke message sent in subclause 6.3.4.5.2;
   d. shall enter the 'G: pending Floor Revoke' state as specified in the subclause 6.3.4.5.2;
   e. shall insert the floor participant into the active floor request queue to the position in front of all queued requests, if not inserted yet or update the position of the floor participant in the active floor request queue to the position in front of all other queued requests, if already inserted; and
   f. shall send a Floor Queue Position Info message to the requesting floor participant, if negotiated support of queueing of floor requests as specified in clause 14. The Floor Queue Position Info message:
      i. include the queue position and floor priority in the Queue Info field; and
      ii. if the Floor Request message included a Track Info field, shall include the received Track Info field; and

3. if allow media from both the current speaker and from the participant now requesting floor with a pre-emptive priority is selected:

   a. shall enter the state 'D: Floor Taken' as specified in the subclause 6.3.6.3.2

6.3.4.4.8 Receive Floor request message from permitted floor participant (R: Floor Request)

Upon receiving a floor request message from the floor participant that has been granted permission to send media, the floor control arbitration logic in the floor control server:

1. shall send a Floor Granted message to the previously granted floor participant. The Floor Granted message:

   a. shall include the value of timer T2 (stop talking) in the Duration field;

   b. shall include the granted priority in the Floor priority field; and

   c. if the Floor Request message included a Track Info field, shall include the received Track Info field; and

2. shall remain in the 'G: Floor Taken' state.

6.3.4.4.9 Timer T20 (Floor Granted) expired

On expiry of timer T20 (Floor Granted), the floor control arbitration logic in the floor control server:

1. shall send a Floor Granted message to the granted floor participant if counter C20 (Floor Granted) has not reached its upper limit: The Floor Granted message:

   a. shall include the value of timer T2 (Stop talking) in the Duration field; and

   b. shall include the granted priority in the Floor priority field;

2. shall start timer T20 (Floor Granted) and increment counter C20 (Floor Granted) by 1 if counter C20 (Floor Granted) has not reached its upper limit; and

3. shall remain in the 'G: Floor Taken' state.

6.3.4.4.10 Timer T20 (Floor Granted) expired N times

When timer T20 (Floor Granted) expires and counter C20 (Floor Granted) reaches its upper limit, the floor control arbitration logic in the floor control server:

1. shall remain in the 'G: Floor Taken' state.

6.3.4.4.11 Permitted MCPTT client release

If the floor control server receives an indication from the floor control interface towards the MCPTT client that the MCPTT client has started to disconnect from the MCPTT call, the floor control arbitration logic in the floor control server:

1. shall enter the 'G: Floor Idle' state as specified in the subclause 6.3.4.3.2.

6.3.4.4.12 Receive an implicit floor request (R: Implicit floor request)

Upon receiving an implicit floor request due to an upgrade to an emergency group call, the floor control arbitration logic in the floor control server:

1. shall stop timer T1 (end of RTP media), if running;

2. shall stop timer T20 (Floor Granted), if running;

3. shall set the Reject Cause field in the Floor Revoke message to #4 (Media Burst pre-empted);

4. shall enter the 'G: pending Floor Revoke' state as specified in the subclause 6.3.4.5.2;

5. shall insert the floor participant into the active floor request queue to the position in front of all queued requests, if not inserted yet or update the position of the floor participant in the active floor request queue to the position in front of all other queued requests, if already inserted; and

6. shall send a Floor Queue Position Info message to the requesting floor participant, if negotiated support of queueing floor requests as specified in clause 14. The Floor Queue Position Request message:

    a. shall include the queue position and floor priority in the Queue Info field.

6.3.4.5 State: 'G: pending Floor Revoke'

6.3.4.5.1 General

The floor control arbitration logic in the floor control server uses this state after having sent a Floor Revoke message to the permitted floor participant.

Timer T3 (stop talking grace) is running when the floor control arbitration logic in the floor control server is in this state.

In this state the MCPTT server forwards RTP media packets to the other floor participants in the MCPTT call.

6.3.4.5.2 Enter state 'G: pending Floor Revoke'

When entering this state the floor control arbitration logic in the floor control server:

1. shall send the Floor Revoke message to the permitted floor participant. The Floor Revoke message:

    a. shall include the reason for sending the Floor Revoke message in the <Reject Cause> value in the Reject Cause field; and

    b. if the <Reject Cause> value is set to #2, may include a retry after value in the <Reject Phrase> value based on local policy;

2. shall start timer T3 (stop talking grace); and

3. shall set the general state to 'G: pending Floor Revoke'.

6.3.4.5.3 Receive RTP media packets (R: Media)

Upon receiving an indication from the media distributor in the MCPTT server that RTP media packets are received from the permitted floor participant the floor control server:

1. shall restart timer T1 (end of RTP media);

NOTE 1: If the upper limit for timer T3 (stop talking grace) is less than the upper limit of timer T1 (end of RTP media) then timer T1 (end of RTP media) will not expire.

2. shall instruct the media distributor to forward the RTP media packets to MCPTT clients according to local policy; and

NOTE 2: If dual floor control is ongoing as described in subclause 6.3.6, the list of floor participants that receive the overriding, overridden, or both transmissions is based on configuration.

3. shall remain in the 'G: pending Floor Revoke' state.

6.3.4.5.4 Receive Floor Release message (R: Floor Release)

Upon receiving a Floor Release message the floor control arbitration logic in the floor control server:

1. shall request the media distributor in the MCPTT server to stop forwarding RTP media packets;

2. shall stop timer T1 (end of RTP media) , if running;

3. shall stop timer T3 (stop talking grace); and

4. enter state 'G: Floor Idle' as specified in the subclause 6.3.4.3.2.

6.3.4.5.5 Timer T3 (stop talking grace) expired

On expiry of timer T3 (stop talking grace) the floor control arbitration logic in the floor control server:

1. shall indicate to the interface towards the MCPTT client that the general state machine is now 'G: Floor Idle'; and
2. shall enter state 'G: Floor Idle' as specified in the subclause 6.3.4.3.2.

6.3.4.5.6 Timer T1 (end of RTP media) expired

On expiry of timer T1 (end of RTP media) the floor control arbitration logic in the floor control server:

1. shall stop timer T3 (stop talking grace); and
2. shall enter state 'G: Floor Idle' as specified in the subclause 6.3.4.3.2.

6.3.4.6 In any state

6.3.4.6.1 General

This subclause describes the actions to be taken in all states defined for the general state diagram with the exception of the 'Start-stop' state.

6.3.4.6.2 Receive MCPTT call release - 1

This subclause is used by the floor control arbitration logic in the floor control server when an MCPTT call is released.

Upon receiving an MCPTT call release step 1 request from the application and signalling plane the floor control arbitration logic in the floor control server:

1. shall request the media distributor in the MCPTT server to stop sending RTP media packets MCPTT clients; and
2. shall enter the 'Releasing' state.

6.3.4.6.3 Receive an instruction to merge group calls (R: Merge)

Upon receiving an instruction from the application and signalling plane to merge the ongoing group call with other group calls, the floor control server:

1. shall perform the actions in subclause 6.5.2.3.

6.3.4.7 State: 'Releasing'

6.3.4.7.1 General

The floor control arbitration logic in the floor control server uses this state while waiting for the application and signalling plane to finalize the disconnection of an MCPTT call.

6.3.4.7.2 Receive MCPTT call release - 2

Upon receiving an MCPTT call release step 2 request from the application and signalling plane, the floor control arbitration logic in the floor control server:

1. shall release all resources reserved in the media plane including the instances used for the 'Floor control server state transition diagram for general floor control operation', and 'Floor control server state transition diagram for basic floor control operation towards the floor participant' state machines and any running timers associated with the state machines; and
2. shall enter the 'Start-stop' state.

6.3.5 Floor control server state transition diagram for basic floor control operation towards the floor participant

6.3.5.1 General

The floor control interface towards the MCPTT client in the floor control server shall behave according to the state diagram and state transitions specified in this subclause.

Figure 6.3.5.1-1 shows the states and state transitions for an associated floor participant in the floor control server.

Figure 6.3.5.1-1: Floor control server state transition diagram for basic floor control operation towards the floor participant

The floor control interface towards the MCPTT client in the floor control server shall create one instance of the 'basic floor control operations' state machine towards the MCPTT client for every floor participant served by the floor control server as follows:

1. For pre-arranged group call in case of an originating MCPTT call, the 'basic floor control operation towards the floor participant' state machine shall be created when the MCPTT server sends the SIP 200 (OK) response towards the originating MCPTT client.

2. For pre-arranged group call in case of a terminating MCPTT call, the 'basic floor control operation towards the floor participant' state machine shall be created when the floor control server receives the SIP 200 (OK) response.

3. For chat group call the 'basic floor control operation state machine towards the floor participant' shall be created when the MCPTT server sends the SIP 200 (OK) response to the received initial SIP INVITE request.

The floor participant associated to the 'basic floor control operation towards the floor participant' state machine is here referred to as the "associated floor participant".

The external inputs to the state machine are:

1. directives coming from the floor control arbitration logic;
2. floor messages sent by the floor participants;
3. media; and
4. in certain cases, SIP messages used for call handling.

If floor control messages or RTP media packets arrives in a state where there is no procedure specified in the following subclauses, the floor control interface towards the MCPTT client in the floor control server:

1. shall discard the floor control message;
2. shall request the network media interface in the MCPTT server to discard any received RTP media packet; and
3. shall remain in the current state.

State details are explained in the following subclauses.

6.3.5.2 State: 'Start-stop'

6.3.5.2.1 General

When a new instance of the 'basic floor control operations towards the floor participant' state machine is created, before any floor control related input is applied, the state machine is in the 'Start-stop' state. Similarly when the call is released the state machine shall return to the Start-Stop state.

An association between the floor control server and a floor participant in the MCPTT client is created, when the state machine is created; and

1. in case of an originating MCPTT call, when the MCPTT server sends the SIP 200 (OK) response to the originating MCPTT client; and
2. in case of a terminating MCPTT call, when the floor control server receives the SIP 200 (OK) response sent from the terminating MCPTT client.

6.3.5.2.2 SIP Session initiated

When a SIP Session is established and:

1. if an MCPTT client initiates an MCPTT call with an implicit floor request, and the MCPTT call does not exist yet, the floor control interface towards the MCPTT client in the floor control server:
   a. shall initialize a general state machine as specified in subclause 6.3.4.2.2; and

NOTE 1: In the subclause 6.3.4.2.2 the 'general floor control operation' state machine will continue with the initialization of the 'general floor control operation' state machine.

   b. shall enter the state 'U: permitted' as specified in the subclause 6.3.5.5.2;

2. if the associated MCPTT client rejoins an ongoing MCPTT call without an implicit floor request or initiates or joins a chat group call without an implicit floor request or attempts to initiate an already existing MCPTT call without an implicit floor request, and
   a. if an MCPTT call already exists but no MCPTT client has the permission to send a media, the floor control interface towards the MCPTT client in the floor control server:
      i. should send a Floor Idle message to the MCPTT client. The Floor Idle message:

A. shall include a Message Sequence Number field with a Message Sequence Number value increased with 1; and

ii. shall enter the state 'U: not permitted and Floor Idle' as specified in the subclause 6.3.5.5.2;

b. if an MCPTT call is initiated, the floor control interface towards the MCPTT client in the floor control server:

i. shall enter the state 'U: not permitted and Floor Idle' as specified in the subclause 6.3.5.5.2; and

ii. shall initialize a general state machine as specified in subclause 6.3.4.2.2; and

NOTE 2: In the subclause 6.3.4.2.2 the general state machine will continue with the initialization of the general state machine.

c. if another MCPTT client has the permission to send a media, the floor control interface towards the MCPTT client in the floor control server:

i. should send a Floor Taken message to the MCPTT client. The Floor Taken message:

A. shall include the granted MCPTT users MCPTT ID in the Granted Party's Identity field, if privacy is not requested;

B. shall include a Message Sequence Number field with a <Message Sequence Number> value increased with 1;

C. if the session is a broadcast group call, shall include the Permission to Request the floor field set to '0'; and

D. if the session is not a broadcast group call, may include the Permission to Request the floor field set to '1';

ii. shall enter the 'U: not permitted and Floor Taken' state as specified in the subclause 6.3.5.4.2;

3. if the associated floor participant attempts to initiate an already existing MCPTT call with an implicit floor request, and

a. if no MCPTT client has the permission to send media, the floor control interface towards the MCPTT client in the floor control server:

i. shall processes the implicit floor request as if a Floor Request message was receive as specified in subclause 6.3.4.3.3; and

ii. shall enter the state 'U: permitted' as specified in the subclause 6.3.5.5.2;

b. if the MCPTT client negotiated support of queueing floor requests as specified in clause 14 and if another MCPTT client has the permission to send media, the floor control interface towards the MCPTT client in the floor control server:

i. shall set the priority level to the negotiated maximum priority level that the MCPTT client is permitted to request, except for pre-emptive priority, when high priority is used;

NOTE 3: The maximum floor priority the floor participant is permitted to request is negotiated in the "mc_priority" fmtp attribute as specified in clause 14.

NOTE 4: The initial implicit floor request will not result in pre-emption when an MCPTT client is joining an ongoing MCPTT call. If the MCPTT client wants to pre-empt the current MCPTT client that are sending media, an explicit floor request with pre-emptive floor priority is required.

ii. shall insert the MCPTT client into the active floor request queue to the position immediately following all queued floor requests with the same floor priority;

iii. shall send a Floor Queue Position Info message to the MCPTT client. The Floor Queue Position Info message:

- shall include the queue position and floor priority in the Queue Info field;

iv. should send a Floor Queue Position Info message with the updated status to the MCPTT clients in the active floor request queue which negotiated queueing of floor requests as specified in clause 14, which have requested the queue status, whose queue position has been changed since the previous Floor Queue Position Info message and which is not the joining MCPTT client. The Floor Queue Position Info message:

- shall include the queue position and floor priority in the Queue Info field; and

vi. shall enter the 'U: not permitted and Floor Taken' state as specified in the subclause 6.3.5.4.2; and

c. if the MCPTT client did not negotiate queueing of floor requests and if another MCPTT client has the permission to send a media, the floor control interface towards the MCPTT client in the floor control server:

i. shall send a Floor Taken message to the MCPTT client. The Floor Taken message:

A. shall include the granted MCPTT users MCPTT ID in the Granted Party's Identity field, if privacy is not requested;

B. shall include a Message Sequence Number field with a Message Sequence Number value increased with 1;

C. if the session is a broadcast group call, shall include the Permission to Request the floor field set to '0'; and

D. if the session is not a broadcast group call, may include the Permission to Request the floor field set to '1'; and

ii. shall enter the 'U: not permitted and Floor Taken' state as specified in the subclause 6.3.5.4.2; and

4. if the MCPTT client is invited to the MCPTT call and

a. if another MCPTT client has permission to send a media, the floor control interface towards the MCPTT client in the floor control server:

i. should send a Floor Taken message to the MCPTT client. The Floor Taken message:

A. shall include the granted MCPTT users MCPTT ID in the Granted Party's Identity field, if privacy is not requested;

B. shall include a Message Sequence Number field with a Message Sequence Number value increased with 1;

C. if the session is a broadcast group call, shall include the Permission to Request the floor field set to '0'; and

D. if the session is not a broadcast group call, may include the Permission to Request the floor field set to '1';

ii. shall enter the 'U: not permitted and Floor Taken' state as specified in the subclause 6.3.5.4.2; and

b. if no other MCPTT client has the permission to send a media; the floor control interface towards the MCPTT client in the floor control server:

i. should send a Floor Idle message to the MCPTT client. The Floor Idle message:

A. shall include a Message Sequence Number field with a <Message Sequence Number> value increased with 1; and

ii. shall enter the 'U: not permitted and Floor Idle' state as specified in the subclause 6.3.5.3.2.

6.3.5.3 State: 'U: not permitted and Floor Idle'

6.3.5.3.1 General

The floor control interface towards the MCPTT client in the floor control server uses this state when the associated floor participant is not permitted to send media.

6.3.5.3.2 Enter state 'U: not permitted and Floor Idle'

When entering this state the floor control interface towards the MCPTT client in the floor control server:

1. if a Track Info field is stored, shall remove the Track Info field from the storage; and
2. shall set the state for the associated floor participant to 'U: not permitted and Floor Idle'.

6.3.5.3.3 Send Floor Taken message (S: Floor Taken)

When a Floor Taken message is received from the floor control server arbitration logic, the floor control interface towards the MCPTT client in the floor control server:

1. shall forward the Floor Taken message to the associated floor participant;
2. may set the first bit in the subtype of the Floor Taken message to '1' (Acknowledgment is required) as described in subclause 8.3.2, and

NOTE: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

3. shall enter the 'U: not permitted and Floor Taken' state as specified in the subclause 6.3.5.4.2.

6.3.5.3.4 Receive Floor Request message (R: Floor Request)

Upon receiving a Floor Request message from the associated floor participant, the floor control interface towards the MCPTT client in the floor control server:

1. if the session is not a broadcast group call or if the session is a broadcast group call and the associated floor participant is the initiator of the broadcast group call, shall forward the Floor Request message to the floor control server arbitration logic;

NOTE 1: The Floor Request message can contain a Floor Indicator field indicating that the floor request is an attempt to upgrade a group call to a broadcast group call. If the floor control arbitration logic accepts the floor request, the ongoing group call will be upgraded accordingly by the Floor Granted message and, for other participants, by the Floor Taken message.

NOTE 2 Initiating a broadcast group call is done in the application and signalling plane using SIP. Initiating or upgrading a call to an emergency call or an imminent peril call is done in the application and signalling plane using SIP.

2. if the session is a broadcast group call and the associated floor participant is not the initiator of the broadcast group call, shall send a Floor Deny message to the associated floor participant. The Floor Deny message:
   a. shall include in the Reject Cause field the <Reject Cause> value cause #5 (Receive only);
   b. may include in the Reject Cause field an additional text string explaining the reason for rejecting the floor request in the <Reject Phrase> value; and
   c. may set the first bit in the subtype of the Floor Deny message to '1' (Acknowledgment is required) as described in subclause 8.3.2; and

NOTE 3: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

3. shall remain in the 'U: not permitted and Floor Idle' state.

6.3.5.3.5 Send Floor Grant message (S: Floor Grant)

When a Floor Granted message is received from the floor control arbitration logic in the MCPTT server, the floor control interface towards the MCPTT client in the floor control server:

1. shall forward the Floor Granted messages to the associated floor participant;

2. may set the first bit in the subtype of the Floor Granted message to '1' (Acknowledgment is required) as described in subclause 8.3.2; and

NOTE: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

3. shall enter the state 'U: permitted' as specified in subclause 6.3.5.5.2.

6.3.5.3.6 Send Floor Deny message (S: Floor Deny)

When a Floor Deny message is received from the floor control arbitration logic in the MCPTT server, the floor control interface towards the MCPTT client in the floor control server:

1. shall forward the Floor Deny messages to the associated floor participant;

2. may set the first bit in the subtype of the Floor Deny message to '1' (Acknowledgment is required) as described in subclause 8.3.2; and

NOTE: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

3. shall remain in the 'U: not permitted and Floor Idle' state.

6.3.5.3.7 Receive Floor Release message (R: Floor Release)

Upon receiving a Floor Release message from the associated floor participant, the floor control interface towards the MCPTT client in the floor control server:

1. if the first bit in the subtype of the Floor Release message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:

   a. shall include the Message Type field set to '4' (Floor Release); and

   b. shall include the Source field set to '2' (the controlling MCPTT function is the source);

2. shall send a Floor Idle message to the associated floor participant. The Floor Idle message:

   a. shall include a Message Sequence Number field with a <Message Sequence Number> value increased with 1;

3. may set the first bit in the subtype of the Floor Idle message to '1' (Acknowledgment is required) as described in subclause 8.3.2;

NOTE: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

4. if a Track Info field is included in the Floor Release message, shall use the topmost <Participant Reference> value and the SSRC in the received Floor Release message to check if the floor participant has a queued floor request;

5. if a no Track Info field is included in the Floor Release message, shall use the SSRC in the received Floor Release message to check if the floor participant has a queued floor request;

6 if the floor participant has a floor request in the queue, shall remove the queued floor request from the queue; and

7. shall remain in the state 'U: not permitted and Floor Idle' state.

6.3.5.3.8 Receive RTP media packets (R: Media)

Upon receiving an indication from the network media interface that RTP media packets are received with payload from the associated floor participant and if Floor Release message was received in the previous 'U: permitted' state, the floor control interface towards the MCPTT client in the floor control server:

NOTE: Reception of unauthorized RTP media packets can only happen if the associated floor participant is in an MCPTT client. If the associated floor participant is a floor control server interface in a non-controlling function of an MCPTT group, the unauthorized RTP media packets are handled in the non-controlling function.

1. shall request the network media interface in the MCPTT server to not forward the received RTP media packets to the media distributor in the MCPTT server;

2. shall send a Floor Revoke message to the associated floor participant. The Floor Revoke message:

   a. shall include the Reject Cause field with the <Reject Cause> value set to #3 (No permission to send a Media Burst); and

3. shall enter the 'U: not permitted but sends media' state as specified in the subclause 6.3.5.7.2.

6.3.5.3.9 Receive an implicit floor request (R: Implicit floor request)

When an ongoing session is upgraded to an emergency group call and when the application and signalling plane indicates that a subsequent SDP offer included the "mc_implicit_request" fmtp attribute as described in clause 14, the floor control interface towards the MCPTT client in the floor control server:

1. shall indicate to the floor control server arbitration logic that an implicit floor request is received due to an upgrade to an emergency group call; and

2. shall remain in the 'U: not permitted and Floor Idle' state.

6.3.5.4 State 'U: not permitted and Floor Taken'

6.3.5.4.1 General

The floor control interface towards the MCPTT client in the floor control server uses this state when another MCPTT client (i.e. not the associated floor participant) has been given permission to send media.

In this state RTP media packets received from the media distributor in the MCPTT server are forwarded to the associated floor participant by the network media interface in the MCPTT server.

6.3.5.4.2 Enter state 'U: not permitted and Floor Taken'

When entering this state the floor control server:

1. if a Track Info field is stored, shall remove the Track Info field from the storage; and

2. shall set the state to 'U: not permitted and Floor Taken'.

6.3.5.4.3 Send Floor Idle message (S: Floor Idle)

When receiving a Floor Idle message from the floor control server arbitration logic in the MCPTT server, the floor control interface towards the MCPTT client in the floor control server:

1. shall forward the Floor Idle message to the associated floor participant;

2. may set the first bit in the subtype of the Floor Idle message to '1' (Acknowledgment is required) as described in subclause 8.3.2; and

NOTE: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

3. shall enter the 'U: not permitted and Floor Idle' state as specified in the subclause 6.3.5.3.2.

6.3.5.4.4 Receive Floor Request message (R: Floor Request)

Upon receiving a Floor Request message from the associated floor participant and if the MCPTT client did not negotiate queueing of floor requests or did not include a priority in the "mc_priority" fmtp attribute as specified in clause 14, the floor control interface towards the MCPTT client in the floor control server:

1. shall send a Floor Deny message to the associated floor participant. The Floor Deny message:

   a. shall include in the Reject Cause field the <Reject Cause> value cause #1 (Another MCPTT client has permission);

   b. may include in the Reject Cause field an additional text string explaining the reason for rejecting the floor request in the <Reject Phrase> value; and

   c. if the Floor Request included a Track Info field, shall include the received Track Info field;

2. may set the first bit in the subtype of the Floor Deny message to '1' (Acknowledgment is required) as described in subclause 8.3.2; and

NOTE 1: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

3. shall remain in the 'U: not permitted and Floor Taken' state.

Upon receiving a Floor Request message from the associated floor participant and the session is a broadcast group call, the floor control interface towards the MCPTT client in the floor control server:

1. shall send a Floor Deny message to the associated floor participant. The Floor Deny message:

   a. shall include in the Reject Cause field the <Reject Cause> value cause #5 (Receive only); and

   b. may include in the Reject Cause field an additional text string explaining the reason for rejecting the floor request in the <Reject Phrase> value;

2. may set the first bit in the subtype of the Floor Deny message to '1' (Acknowledgment is required) as described in subclause 8.3.2; and

NOTE 2: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

3. shall remain in the 'U: not permitted and Floor Taken' state.

Upon receiving a Floor Request message from the associated floor participant and if the MCPTT client negotiated support of queueing of floor requests or included a floor priority in the "mc_priority" or both as described in specified in clause 14 and according to local policy, the floor control interface towards the MCPTT client in the floor control server:

1. shall determine the effective priority level as described in subclause 4.1.1.3 and as follows:

   a. the lower of the floor priority included in Floor Request message and the negotiated maximum floor priority that the MCPTT client is permitted to request, if the MCPTT client negotiated floor priority "mc_priority" and floor priority is included in the Floor Request message;

   b. the receive only floor priority, if the MCPTT client negotiated floor priority in the "mc_priority" fmtp attribute and if the negotiated maximum floor priority that the MCPTT client is permitted to request is "receive only";

   c. the default floor priority, if the MCPTT client negotiated floor priority in the "mc_priority" fmtp attribute, if the negotiated maximum floor priority that the MCPTT client is permitted to request is not receive only and if the floor priority is not included in the Floor Request message; and

   d. the default floor priority, if the MCPTT client did not negotiate floor priority in the "mc_priority" fmtp attribute;

2. if the effective floor priority is "receive only", the floor control interface towards the MCPTT client in the floor control server:

   a. shall send a Floor Deny message to the floor participant. The Floor Deny message:

i. shall include in the Reject Cause field the <Reject Cause> value cause #5 (Receive only) ;

ii. may include in the Reject Cause field an additional text string explaining the reason for rejecting the floor request in the <Reject Phrase> value; and

iii. if the Floor Request included a Track Info field, shall include the received Track Info field; and

b. shall remain in the 'U: not permitted and Floor Taken' state;

3. if

a. a Track Info field is included in the Floor Request message, shall use the topmost <Participant Reference> value and the SSRC in the received Floor Request message to check if the floor participant has a queued floor request; or

b. a Track Info field is not included in the Floor Request message, shall use the SSRC in the received Floor Request message to check if the floor participant has a queued floor request;

4. if the floor participant already has a queued floor request with the same effective priority level, the floor control interface towards the MCPTT client in the floor control server:

a. shall send a Floor Queue Position Info message to the requesting MCPTT client, if the MCPTT client negotiated support of queueing of floor requests as specified in clause 14. The Floor Queue Position Info message:

i. shall include the queue position and floor priority in the Queue Info field; and

ii. if the Floor Request included a Track Info field, shall include the received Track Info field;

5. if the effective priority level is pre-emptive and there are no other pre-emptive requests in the active floor request queue and the effective priority level of the current MCPTT client with permission to send a media is not the pre-emptive priority, the floor control interface towards the MCPTT client in the floor control server:

a. shall forward the Floor Request message to the floor control server arbitration logic indicating that a Floor Request message with pre-emptive priority is received;

NOTE: The Floor control server arbitration logic initiates revoking the permission to send media towards the current MCPTT client with the permission to send media as specified in the subclause 6.3.4.4.7;

6. if the MCPTT client did not negotiate support of queueing of floor requests as specified in clause 14, the effective priority level is pre-emptive and either other pre-emptive request is queued or the effective priority level of the current MCPTT client with permission to send a media is the pre-emptive priority, the floor control interface towards the MCPTT client in the floor control server:

a. shall send a Floor Deny message to the associated floor participant. The Floor Deny message:

i. shall include in the Reject Cause field the <Reject Cause> value cause #1 (Another MCPTT client has permission);

ii. may include in the Reject Cause field an additional text string explaining the reason for rejecting the floor request in the <Reject Phrase> value; and

iii. if the Floor Request included a Track Info field, shall include the received Track Info field; and

b. shall remain in the 'U: not permitted and Floor Taken' state;

7. if the MCPTT client did not negotiate "queueing" and the effective priority level is not pre-emptive, the floor control interface towards the MCPTT client in the floor control server:

a. shall send a Floor Deny message to the associated floor participant. The Floor Deny message:

i. shall include in the Reject Cause field the <Reject Cause> value cause #1 (Another MCPTT client has permission);

ii. may include in the Reject Cause field an additional text string explaining the reason for rejecting the floor request in the <Reject Phrase> value; and

iii. if the Floor Request included a Track Info field, shall include the received Track Info field; and

b. shall remain in the 'U: not permitted and Floor Taken' state; and

8. if the MCPTT client negotiated support of queueing of floor requests as specified in clause 14 and the effective priority level is not pre-emptive, the floor control interface towards the MCPTT client in the floor control server:

   a. shall insert the MCPTT client into the active floor request queue, if not inserted yet, or update the position of the MCPTT client in the active floor request queue, if already inserted, to the position immediately following all queued requests at the same effective priority level;

   b. the floor control server shall send a Floor Queue Position Info message to the floor participant. The Floor Queue position message:

      i. shall include the queue position and floor priority in the Queue Info field; and

      ii. if the Floor Request included a Track Info field, shall include the received Track Info field;

   c. shall remain in the 'U: not permitted and Floor Taken' state; and

   d. may set the first bit in the subtype of the Floor Queue Position message to '1' (Acknowledgment is required) as described in subclause 8.3.2.

NOTE 4: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

6.3.5.4.5 Receive Floor Release message (R: Floor Release)

Upon receiving a Floor Release message from the associated floor participant and if the MCPTT client did not negotiate support of queueing of floor requests or included a floor priority in the "mc_priority" fmtp attribute as specified in clause 14, the floor control interface towards the MCPTT client in the floor control server:

1. if the first bit in the subtype of the Floor Release message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:

   a. shall include the Message Type field set to '4' (Floor Release); and

   b. shall include the Source field set to '2' (the controlling MCPTT function is the source);

2. shall send a Floor Taken message to the associated floor participant. The Floor Taken message:

   a. shall include the granted MCPTT users MCPTT ID in the Granted Party's Identity field, if privacy is not requested;

   b. shall include a Message Sequence Number field with a <Message Sequence Number> value increased with 1;

   c. shall include the Permission to Request the floor field set to '0', if the floor participants are not allowed to request the floor;

   d. if the Floor Release message included a Track Info field, shall include the received Track Info field; and

   e. may set the first bit in the subtype of the Floor Taken message to '1' (Acknowledgment is required) as described in subclause 8.3.2; and

NOTE 1: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

3. shall remain in the 'U: not permitted and Floor Taken' state.

Upon receiving a Floor Release message from the associated floor participant and if the MCPTT client negotiated support of queueing of floor requests as specified in clause 14, the floor control interface towards the MCPTT client in the floor control server:

1. if the first bit in the subtype of the Floor Release message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:

a. shall include the Message Type field set to '4' (Floor Release); and

b. shall include the Source field set to '2' (the controlling MCPTT function is the source);

2. if

a. a Track Info field is included in the Floor Release message, shall use the topmost <Participant Reference> value and the SSRC in the received Floor Release message to check if the floor participant has a queued floor request; or

b. if a Track Info field is not included in the Floor Release message, shall use the SSRC in the received Floor Release message to check if the floor participant has a queued floor request;

3. shall remove the MCPTT client from the active floor request queue, if the MCPTT client was in the active floor request queue;

4. shall send a Floor Taken message to the associated floor participant. The Floor Taken message:

a. shall include the granted MCPTT users MCPTT ID in the Granted Party's Identity field, if privacy is not requested;

b. if the session is a broadcast group call, shall include the Permission to Request the floor field set to '0';

c. if the session is not a broadcast group call, may include the Permission to Request the floor field set to '1'; and

d. if a Track Info field is included in the Floor Release message, shall include the received Track Info field;

5. may set the first bit in the subtype of the Floor Taken message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2; and

NOTE 2: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

6. shall remain in the 'U: not permitted and Floor Taken' state.

6.3.5.4.6 Receive RTP media packets (R: Media)

Upon receiving an indication from the network media interface in the MCPTT server that RTP media packets with payload are received from the associated floor participant, the floor control interface towards the MCPTT client in the floor control server:

NOTE: Reception of unauthorized RTP media packets can only happen if the associated floor participant is in an MCPTT client. If the associated floor participant is a floor control server interface in a non-controlling function of an MCPTT group, the unauthorized RTP media packets are handled in the non-controlling function.

1. shall request the network media interface to not forward the RTP media packets to the media distributor in the MCPTT server;

2. shall send a Floor Revoke message to the associated floor participant. The Floor Revoke message:

a. shall include the Reject Cause field with the Reject Cause value set to #3 (No permission to send a Media Burst); and

3. shall enter the 'U: not permitted but sends media' state as specified in the subclause 6.3.5.7.2.

6.3.5.4.7 Send Floor Queue Position Info message (R: Floor Queue Position Request)

Upon receiving a Floor Queue Position Request message from the associated floor participant, the floor control interface towards the MCPTT client in the floor control server:

1. shall send the Floor Queue Position Info message. The Floor Queue Position Info message:

a. shall include the queue position and floor priority in the Queue Info field; and

b. if a Track Info field is included in the Floor Queue Position Info message, shall include the received Track Info field;

2. may set the first bit in the subtype of the Floor Queue Position Info message to '1' (Acknowledgment is required) as described in subclause 8.3.2; and

NOTE: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

3. shall remain in the 'U: not permitted and Floor Taken' state.

6.3.5.4.8 Receive an implicit floor request (R: Implicit floor request)

When an ongoing session is upgraded to an emergency group call and when the application and signalling plane indicates that a subsequent SDP offer included the "mc_implicit_request" fmtp attribute as specified in clause 14, the floor control interface towards the MCPTT client in the floor control server:

1. shall indicate to the floor control server arbitration logic that an implicit floor request is received due to an upgrade to an emergency group call; and

2. shall remain in the 'U: not permitted and Floor Taken' state.

6.3.5.5 State: 'U: permitted'

6.3.5.5.1 General

The floor control interface towards the MCPTT client in the floor control server uses this state when the associated floor participant has been given permission to send media.

6.3.5.5.2 Enter state 'U: permitted'

When entering this state the floor control interface towards the MCPTT client in the floor control server:

1. shall set the state for the associated floor participant to 'U: permitted'.

6.3.5.5.3 Receive Floor Release message (R: Floor Release)

Upon receiving a Floor Release message from the associated floor participant, the floor control interface towards the MCPTT client in the floor control server:

1. if the first bit in the subtype of the Floor Release message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:

   a. shall include the Message Type field set to '4' (Floor Release); and

   b. shall include the Source field set to '2' (the controlling MCPTT function is the source);

2. shall forward the Floor Release message to the floor control arbitration logic in the MCPTT server with the first bit in the subtype of the Floor Release message set to '0' (Acknowledgment is not required), if not already set; and

3. shall remain in the state 'U: permitted'.

6.3.5.5.4 Send Floor Idle message (S: Floor Idle)

When receiving the Floor Idle message from the floor control server arbitration logic in the MCPTT server, the floor control interface towards the MCPTT client in the floor control server shall:

1. shall enter the 'U: not permitted and Floor Idle' state as specified in the subclause 6.3.5.3.2.

6.3.5.5.5 Send Floor Revoke message (S: Floor Revoke)

When receiving the Floor Revoke message from the floor control server arbitration logic in the MCPTT server, the floor control interface towards the MCPTT client in the floor control server:

1. shall forward the Floor Revoke message to the floor participant;
2. if the Floor Revoke message includes the Track Info field, shall store the Track Info field; and
3. shall enter the state 'U pending Floor Revoke' as specified in the subclause 6.3.5.6.2.

6.3.5.5.6 Receive RTP media packets (R: media)

Upon receiving an indication from the network media interface in the MCPTT server that RTP media packets with payload are received from the associated floor participant, the floor control interface towards the MCPTT client in the floor control server:

1. shall request the network media interface in the MCPTT server to forward RTP media packets to the media distributor in the MCPTT server.

6.3.5.5.7 Receive Floor Request message (R: Floor Request)

Upon receiving a Floor Request message from the associated floor participant, the floor control interface towards the MCPTT client in the floor control server:

1. shall forward the Floor Request message to the floor control server arbitration logic in the MCPTT server; and
2. shall remain in the 'U: permitted' state.

6.3.5.6 State: 'U: pending Floor Revoke'

6.3.5.6.1 General

The floor control interface towards the MCPTT client in the floor control server uses this state during the grace period after sending the Floor Revoke message.

In this state timer T8 (Floor Revoke) is running.

6.3.5.6.2 Enter state 'U pending Floor Revoke'

When entering this state the floor control interface towards the MCPTT client in the floor control server:

1. shall start timer T8 (Floor Revoke); and
2. shall enter the state 'U: pending Floor Revoke'.

6.3.5.6.3 Timer T8 (media Revoke) expired

On expiry of timer T8 (Floor Revoke) the floor control interface towards the MCPTT client in the floor control server:

1. shall retransmit the Floor Revoke message to the associated floor participant. The Floor Revoke message:
   a. shall include the same Rejection Cause field as in the previous sent Floor Revoke message;
2. shall start timer T8 (Floor Revoke); and
3. shall remain in the 'U: pending Floor Revoke' state.

6.3.5.6.4 Receive RTP media packets (R: media)

Upon receiving an RTP media packet with payload from the associated floor participant, the floor control interface towards the MCPTT client in the floor control server:

1. shall forward RTP media packets to the media distributor; and
2. shall remain in the 'U: pending Floor Revoke' state.

6.3.5.6.5 Receive Floor Release message (R: Floor Release)

Upon receiving a Floor Release message from the associated floor participant, the floor control interface towards the MCPTT client in the floor control server:

1. if the first bit in the subtype of the Floor Release message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:
   a. shall include the Message Type field set to '4' (Floor Release); and
   b. shall include the Source field set to '2' (the controlling MCPTT function is the source);
2. shall forward the Floor Release message to the floor control server arbitration logic; and
3. shall remain in the state 'U: pending Floor Revoke'.

6.3.5.6.6 Send Floor Idle message (S: Floor Idle)

Upon receiving a Floor Idle message from the floor control server arbitration logic in the MCPTT server, the floor control interface towards the MCPTT client in the floor control server:

NOTE 1: The Floor Idle message is sent when timer T3 (stop talking grace) expires and when timer T1 (end of RTP media) expires and when there are no queued floor requests.

1. shall send the Floor Idle message to the associated floor participant;
2. may set the first bit in the subtype of the Floor Idle message to '1' (Acknowledgment is required) as described in subclause 8.3.2; and

NOTE 2: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

3. shall enter the 'U: not permitted and Floor Idle' state as specified in the subclause 6.3.5.3.2.

6.3.5.6.7 Send Floor Taken message (S: Floor Idle)

Upon receiving a Floor Taken message from the floor control server arbitration logic in the MCPTT server, the floor control interface towards the MCPTT client in the floor control server:

NOTE 1: The Floor Taken message is sent when timer T3 (stop talking grace) expires or when timer T1 (end of RTP media) expires and if there are queued floor requests.

1. shall send the Floor Taken message to the associated floor participant;
2. may set the first bit in the subtype of the Floor Taken message to '1' (Acknowledgment is required) as described in subclause 8.3.2; and

NOTE 2: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

3. shall enter the 'U: not permitted and Floor Taken' state as specified in the subclause 6.3.5.3.2.

6.3.5.7 State 'U: not permitted but sends media'

6.3.5.7.1 General

The floor control interface towards the MCPTT client in the floor control server uses this state when it receives RTP media packets from the MCPTT client and the MCPTT client is not permitted to send media.

Timer T8 (Floor Revoke) is running in this state.

6.3.5.7.2 Enter state 'U: not permitted but sends media'

When entering this state the floor control interface towards the MCPTT client in the floor control server:

1. shall start timer T8 (Floor Revoke); and
2. shall enter the state 'U: not permitted but sends media'.

In this state the floor control interface towards the MCPTT client in the floor control server:

1. shall not request the network media interface in the MCPTT server to forward RTP media packets from the MCPTT client to the media distributor in the MCPTT server.

6.3.5.7.3 Timer T8 (Floor Revoke) expired

On expiry of timer T8 (Floor Revoke), the floor control interface towards the MCPTT client in the floor control server:

1. shall send a Floor Revoke message to the associated floor participant. The Floor Revoke message:
   a. shall include in the Rejection Cause field the <Rejection Cause> value set to #3 (No permission to send a Media Burst);
2. shall restart timer T8 (Floor Revoke); and
3. shall remain in the 'U: not permitted but sends media' state.

NOTE: The number of times the floor control server retransmits the Floor Revoke message and the action to take when the floor control server gives up is an implementation option. However, the recommended action is that the MCPTT client is disconnected from the MCPTT call.

6.4.5.7.4 Receive Floor Release message (R: Floor Release)

Upon receiving a Floor Release message, the floor control interface towards the MCPTT client in the floor control server:

1. if the first bit in the subtype of the Floor Release message is set to '1' (Acknowledgment is required) as described in subclause 8.3.2, shall send a Floor Ack message. The Floor Ack message:
   a. shall include the Message Type field set to '4' (Floor Release); and
   b. shall include the Source field set to '2' (the controlling MCPTT function is the source);
2. if the general state is 'G: Floor Idle', the floor control interface towards the MCPTT client in the floor control server:
   a. shall send the Floor Idle message; and
   b. shall enter the 'U: not permitted and Floor Idle' state as specified in the subclause 6.3.5.3.2; and
3. if the general state is 'G: Floor Taken', the floor control interface towards the MCPTT client in the floor control server:
   a. shall send a Floor Taken message. The Floor Taken message shall be populated as follows:
      i. shall include the granted MCPTT users MCPTT ID in the Granted Party's Identity field, if privacy is not requested;
      ii. if the session is a broadcast group call, shall include the Permission to Request the floor field set to '0'; and
      iii. if the session is not a broadcast group call, may include the Permission to Request the floor field set to '1';
   b. may set the first bit in the subtype of the Floor Taken message to '1' (Acknowledgment is required) as described in subclause 8.3.2; and

NOTE: It is an implementation option to handle the receipt of the Floor Ack message and what action to take if the Floor Ack message is not received.

c. shall enter the 'U: not permitted and Floor Taken' state as specified in the subclause 6.3.5.4.2.

6.3.5.8 In any state

6.3.5.8.1 General

This subclause describes the actions to be taken in all states defined for the basic state diagram with the exception of the 'Start-stop' and 'Releasing' states.

6.3.5.8.2 Receive MCPTT call release – 1

Upon receiving an MCPTT call release step 1 request from the application and signalling plane e.g. when the MCPTT call is going to be released or when the MCPTT client leaves the MCPTT call, the floor control interface towards the MCPTT client in the floor control server:

1. shall stop sending floor control messages to the associated floor participant;
2. shall request the network media interface to stop sending RTP media packets towards to the associated MCPTT client;
3. shall ignore any floor control messages received from the associated floor participant;
4. shall request the network media interface to stop forwarding RTP media packets from the associated MCPTT client to the media distributor in the MCPTT server;
5. shall indicate to the floor control server arbitration logic in the MCPTT server that the MCPTT client has started to disconnect from the MCPTT call; and
6. shall enter the 'Releasing' state.

6.3.5.8.3 Receiving a merging instruction (R: Merge)

Upon receipt of an instruction to merge with another group due to the group regrouping function, the floor control interface towards the MCPTT client:

1. shall create an instance of the 'floor participant interface state transition' as specified in subclause 6.5.5;
2. shall move information associated with the instance used for 'floor participant interface state transition' to the 'basic floor control operation towards the floor participant' state machine;

NOTE: Which information that needs to be moved is an implementation option.

3. shall enter the 'Start-stop' state and terminate the 'basic floor control operation towards the floor participant" state machine associated with this floor participant and this MCPTT call;
4. if the state was 'U: permitted and Floor Idle', 'U: pending Floor Revoke', 'U: pending Floor Revoke' or 'U: not permitted but sends media':
   a. shall enter the 'P: has no permission' state as specified in subclause 6.5.5; and
   b. shall perform actions specified in subclause 6.5.5.3; and
5. if the state was 'U: permitted':
   a. shall enter the 'P: has permission' state; and
   b. shall perform actions specified in subclause 6.5.5.4.

6.3.5.9 State: 'Releasing'

6.3.5.9.1 General

The floor control interface towards the MCPTT client in the floor control server uses this state while waiting for the application and signalling plane to finalize the release of the MCPTT call or finalizing the removal of the MCPTT client from the MCPTT call.

6.3.5.9.2 Receive MCPTT call release - 2

Upon receiving an MCPTT call release step 2 request from the application and signalling plane, the floor control interface towards the MCPTT client in the floor control server:

1. shall request the network media interface to release all resources associated with this MCPTT client for this MCPTT call; and
2. shall enter the 'Start-stop' state and terminate the 'basic floor control operation towards the floor participant" state machine associated with this floor participant and this MCPTT call.

6.3.6 Dual floor control

6.3.6.1 General

Dual floor control is used when a floor participant requests floor with a pre-emptive floor priority allowing the floor control in subclause 6.3.4 to continue without revoking the floor from the MCPTT client permitted to send media as specified in 3GPP TS 23.179 [5] subclause 10.9.1.3.2.2.

The floor control server arbitration logic in the floor control server shall behave according to the state diagram and state transitions specified in this subclause.

Figure 6.3.6.1-1 shows the 'dual floor control operation' states (D states) and the state transition diagram.

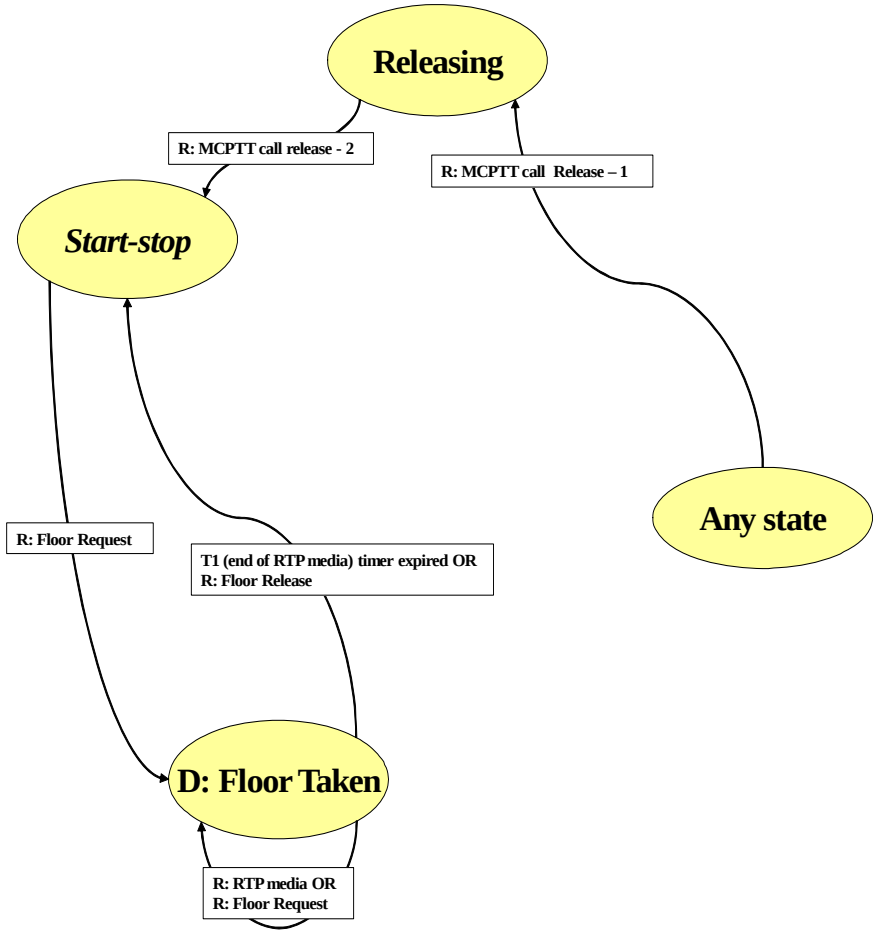


Figure 6.3.6.1-1: Floor control server state transition diagram for 'dual floor control operation'

The floor control arbitration logic in the floor control server shall keep one instance of the 'dual floor control operation' state machine for a floor participant with pre-emptive floor priority where this MCPTT user is allowed to talk without revoking a current speaker with lower flow priority.

NOTE: Only one MCPTT user with this type of pre-emptive floor priority can exist within an MCPTT call.

The floor participant associated to the "dual floor control operation' state machine is in the following subclauses referred to as the overriding MCPTT client.

If floor control messages or RTP media packets arrives in a state where there is no procedure specified in the following subclauses the floor control arbitration logic in the floor control server:

1. shall discard the floor control message;
2. shall request the media distributor in the MCPTT server to discard any received RTP media packet; and
3. shall remain in the current state.

State details are explained in the following subclauses.

6.3.6.2 State: 'Start-stop'

6.3.6.2.1 General

When a new instance of the 'general dual floor control operation' state machine is initiated, before any floor control related input is applied, the state machine is in 'Start-stop' state. Similarly when the media burst is released the state machine shall return to the 'Start-Stop' state or the related MCPTT call is released.

6.3.6.2.2 Receive Floor Request message with overriding pre-emptive floor priority (R: Floor Request)

When a floor participant request floor with an overriding pre-emptive priority is granted the floor the floor control arbitration logic:

1. shall create instance of the 'dual floor control operation' state machine;
2. shall store the SSRC of floor participant;
3. if a Track Info field is included in the Floor Request message, shall store the received Track Info field, and
4 shall enter the state 'D: Floor Taken' as specified in the subclause 6.3.6.3.2.

6.3.6.3 State: 'D: Floor Taken'

6.3.6.3.1 General

The floor control arbitration logic in the floor control server uses this state when it has permitted one floor participant to override a current speaker in an MCPTT call to send media.

Timer T1 (end of RTP media) can be running when the floor control server is in this state.

Timer T2 (stop talking) can be running when the floor control server is in this state.

6.3.6.3.2 Enter state 'D: Floor Taken'

When entering this state the floor control arbitration logic in the floor control server:

1. shall send a Floor Granted message to the requesting floor participant. The Floor Granted message:
   a. shall include the value of timer T2 (stop talking) in the Duration field;
   b. shall include the granted priority in the Floor priority field; and
   c. if a Track Info field is stored, shall include the received Track Info field;
2. shall send a Floor Idle message to those floor participants that will only listen to RTP media from the overriding MCPTT client;
3. shall send a Floor Taken message to other floor participants according to local policy. The Floor Taken message:

NOTE: The MCPTT client overridden by the overriding MCPTT client is still sending voice (overridden). The list of floor participants that receive the overriding, overridden, or both transmissions is based on configuration.

   a. shall include the granted MCPTT users MCPTT ID in the Granted Party's Identity field, if privacy is not requested; and
   b. shall include a Message Sequence Number field with a <Message Sequence Number> value increased with 1;
4. shall start timer T1 (end of RTP media); and
5. shall enter the state to 'D: Floor Taken' state.

6.3.6.3.3 Timer T1 (End of RTP media) expired

On expiry of timer T1 (end of RTP media), the floor control arbitration logic in the floor control server:

1. shall stop timer T2 (stop talking); if running;
2. shall request the media distributor in the MCPTT server to stop distributing RTP media packets (with the exception of RTP media packets already in the buffer, if RTP media buffering is ongoing) to other MCPTT clients;

NOTE: If dual floor control is ongoing as described in subclause 6.3.6, the list of floor participants that receive the overriding, overridden, or both transmissions is based on configuration.

3. shall release all resources reserved in the media plane including the instances used for the 'dual floor control operation' state machine and any running timers associated with the state machine;
4. if the state in the 'general floor control operation' state machine is:
   a. 'G: Taken', shall send a Floor Taken message to those floor participants that only received RTP media from the overriding MCPTT client. The Floor Taken message:
      i. shall include the granted MCPTT users MCPTT ID in the Granted Party's Identity field of the permitted MCPTT client, if privacy is not requested;
   b. 'G: Idle', shall send a Floor Idle message to all floor participants; and
5. shall enter the 'Start-stop' state.

6.3.6.3.4 Timer T2 (Stop talking) expired

On expiry of timer T2 (stop talking) the floor control arbitration logic in the floor control server:

1. shall stop timer T1 (end of RTP media);
2. shall include the Reject Cause field with the <Reject Cause> value set to #2 (Media burst too long) in the Floor Revoke message sent in subclause 6.3.4.5.2; and
3. shall enter the 'D: pending Floor Revoke' state as specified in the subclause 6.3.6.4.2.

6.3.6.3.5 Receive RTP media packets (R: Media)

Upon receiving an indication from the media distributor in the MCPTT server that RTP media packets are received from the permitted MCPTT client, the floor control arbitration logic in the floor control server:

1. shall start timer T2 (stop talking) if not already running;
2. shall restart timer T1 (end of RTP media);
3. shall instruct the media distributor to forward the RTP media packets to MCPTT clients according to local policy; and

NOTE: The MCPTT client overridden by the permitted floor participant is still sending voice (overridden). The list of floor participants that receive the overriding, overridden, or both transmissions is based on configuration.

4. shall remain in the 'D: Floor Taken' state.

6.3.6.3.6 Receive Floor Release message (R: Floor Release)

Upon receiving a Floor Release message the floor control arbitration logic in the floor control server:

1. shall request the media distributor in the MCPTT server to stop distributing RTP media packets (with the exception of RTP media packets already in the buffer, if RTP media buffering is ongoing) to other MCPTT client;

2. shall stop timer T2 (stop talking), if running;

3. shall release all resources reserved in the media plane including the instances used for the 'Floor control server state transition diagram for dual floor control operation' and any running timers associated with the state machine;

4. if the first bit in the subtype of the Floor Release message is set to '1' (acknowledgement is required) as specified in subclause 8.2.2:

   a. shall send a Floor Ack message. The Floor Ack message:

      i. shall set the Source field to the value '2' (the controlling MCPTT function is the source); and

      ii. shall set the Message Type field to floor release;

5. if the state in the 'general floor control operation' state machine is:

   a. 'G: Taken', shall send a Floor Taken message to those floor participants that only received RTP media from the overriding MCPTT client. The Floor Taken message:

      i. shall include the granted MCPTT users MCPTT ID in the Granted Party's Identity field of the permitted MCPTT client, if privacy is not requested; and

   b. 'G: Idle', shall send a Floor Idle message to all floor participants; and

6. shall enter the 'Start-stop' state.

6.3.6.3.7 Receive Floor request message from permitted floor participant (R: Floor Request)

Upon receiving a Floor Request message from the floor participant that has been granted permission to send overriding media, the floor control arbitration logic in the floor control server:

1. shall send a Floor Granted message to the previously granted floor participant. The Floor Granted message:

   a. shall include the value of timer T2 (stop talking) in the Duration field;

   b. shall include the granted priority in the Floor priority field; and

   c. if the Floor Request message included a Track Info field, shall include the received Track Info field; and

2. shall remain in the 'D: Floor Taken' state.

6.3.6.3.8 Permitted MCPTT client release

If the floor control server receives an indication from the floor control interface towards the MCPTT client that the MCPTT client has started to disconnect from the MCPTT call, the floor control arbitration logic in the floor control server:

1. shall request the media distributor in the MCPTT server to stop distributing RTP media packets (with the exception of RTP media packets already in the buffer, if RTP media buffering is ongoing) to other MCPTT clients;

2. shall release all resources reserved in the media plane including the instances used for the 'Floor control server state transition diagram for dual floor control operation' and any running timers associated with the state machine; and

3. shall enter the 'Start-stop' state.

6.3.6.5 In any state

6.3.6.5.1 General

This subclause describes the actions to be taken in all states defined for the general state diagram with the exception of the 'Start-stop' state.

6.3.6.5.2 Receive MCPTT call release - 1

This subclause is used by the floor control arbitration logic in the floor control server when an MCPTT call is released.

Upon receiving an MCPTT call release step 1 request from the application and signalling plane the floor control arbitration logic in the floor control server:

1. shall request the media distributor in the MCPTT server to stop sending RTP media packets MCPTT clients; and
2. shall enter the 'Releasing' state.

6.3.6.6 State: 'Releasing'

6.3.6.6.1 General

The floor control arbitration logic in the floor control server uses this state while waiting for the application and signalling plane to finalize the disconnection of an MCPTT call.

6.3.6.6.2 Receive MCPTT call release - 2

Upon receiving an MCPTT call release step 2 request from the application and signalling plane, the floor control arbitration logic in the floor control server:

1. shall release all resources reserved in the media plane including the instances used for the 'general dual floor control operation' state machine and any running timers associated with the state machine; and
2. shall enter the 'Start-stop' state.

6.4 Participating MCPTT function floor control procedures

6.4.1 General

Once an on-demand MCPTT session is established or a pre-established session is in use when the participating MCPTT function receives floor control messages from the floor participant in the MCPTT client or from the floor control server in the controlling MCPTT function, the behaviour of the participating MCPTT function is described in the following subclauses.

6.4.2 Receive floor control messages

Upon receiving a floor control message the participating MCPTT function:

1. shall immediately forward the floor control message to the floor control server if the message is received from the floor participant; and
2. shall immediately forward the floor control message to the floor participant if the message is received from the floor control server.

6.4.3 Receive RTP media packets (R: RTP Media)

Upon receiving RTP media packets the participating MCPTT function:

1. shall immediately forward the RTP media packet to the controlling MCPTT function if the RTP packet is from an MCPTT client; and

2. shall immediately forward the RTP media packets to the MCPTT client if the RTP packet is from the controlling MCPTT function.

6.4.4 Release of session

When the participating function receives an indication from the application and signalling plane that session release is initiated, the participating MCPTT function:

1. shall stop sending floor control messages towards the floor participant and the floor control server; and

2. shall stop sending RTP media packets towards the MCPTT client and towards the controlling MCPTT function.

When the participating MCPTT function receives an indication from the application and signalling plane that the session is released, the participating MCPTT function:

1. in case of a pre-established session, shall perform the actions in subclause 9.3.2; and

2. in case of an on-demand session, shall release the media resources associated with the session.

6.5 Non-controlling MCPTT function of an MCPTT group

6.5.1 General

The floor control server interface in the non-controlling MCPTT function of an MCPTT group shall support the procedures in subclauses 6.5.2 and 6.5.3 and shall support procedures in subclauses 6.5.4.

The floor participant interface in the non-controlling MCPTT function of an MCPTT group shall support the procedures in subclause 6.5.5.

6.5.2 The MCPTT call initialization procedure in the non-Controlling MCPTT function of an MCPTT group

6.5.2.1 General

The subclause 6.5.2.2 describes the initial procedures when a new SIP session is establishing a group session or a private session with floor control.

The subclause 6.5.2.3 describes the procedure for switching from a controlling MCPTT function mode to a non-controlling MCPTT function mode.

6.5.2.2 Initial procedures when a new SIP session is establishing a group session or a private session with floor control

When receiving an indication from the application and signalling plane that a group session is initiated, the floor control server interface:

1. shall initiate and store a message sequence number value with the value to be used in the Message Sequence Number field in the Floor Idle and Floor Taken messages;

2. shall for each MCPTT client in the MCPTT group controlled by the non-controlling MCPTT function that are participating in the session:

   a. generate a random temporary identifier between '0' and '4294967295';

   b. store an association between the generated temporary identifier and the floor participant interface;

c. store information about capabilities negotiated in the "mc_queueing" and "mc_priority" fmtp attributes as described in clause 14;

d. store information whether the MCPTT client requested privacy or not; and

e. initiate an instance of the 'floor participant state transition' state machine; and

3. perform the actions in the subclause 6.5.4.

When receiving an indication from the application and signalling plane that an MCPTT client has accepted an invitation to the session, the floor participant interface shall perform the actions in subclause 6.5.5.

6.5.2.3 Switching from a controlling MCPTT function mode to a non-controlling MCPTT function mode

6.5.2.3.1 Overview

The switching from working in a controlling MCPTT functional mode to a non-controlling MCPTT functional mode is a 2-step procedure.

Step 1. The controlling MCPTT function prepares for start acting as a non-controlling MCPTT function. The step 1 procedure is specified in subclause 6.5.2.3.2.

Before continuing with step 2 the application and signalling plane needs to receive a confirmation that the SIP session between the floor control server and the interface to the floor control server is established.

Step 2. The controlling MCPTT functions starts acting as a non-controlling MCPTT function. The step 2 procedure is specified in subclause 6.5.2.3.3.

6.5.2.3.2 Preparing for the switch to non-controlling MCPT function (Step 1)

When receiving a request from the application and signalling plane to prepare for merging with another group session, the floor control server:

1. shall release the instant used for 'general floor control operation'; and

2. shall for each MCPTT client in the MCPTT group controlled by the controlling MCPTT function and participating in the session:

a. generate a random temporary identifier between '0' and '4294967295';

b. store an association between the generated temporary identifier and the floor participant interface;

c. store information about capabilities negotiated in the "mc_queueing" and "mc_priority" fmtp attributes as specified in clause 14;

d. store information whether the MCPTT client requested privacy or not; and

e. initiate an instance of the 'floor participant state transition' state machine.

6.5.2.3.3 Start acting as a non-controlling MCPT function (Step 2)

When receiving a request from the application and signalling plane to finalize the switch to non-controlling MCPT function behaviour, the floor control server:

1. start acting as a floor control server interface;

2. if an active floor request queue exists, for each queued floor request in the active floor request queue:

NOTE: The active floor request queue was built up when the non-controlling MCPTT function was acting as a floor control server.

a. shall send a Floor Request message to the floor control server. The Floor Request:

i. shall include all fields included by the floor participant;

ii. if a Track Info field is included, shall include the temporary identifier at the end of the <Floor Participant Reference> value item; and

iii. if a Track Info field is not included:

A. shall include the "mc_queueing" fmtp attribute value negotiated as specified in clause 14 in the <Queueing Capability> value;

B. shall include a <Participant Type> value based on the <Participant Type> element specified in 3GPP TS 24.381 [12], if value in the <Participant Type> element is available, otherwise set the <Participant Type> value to '15' (unknown);

C. shall include the "mc_priority" fmtp attribute value negotiated as specified in clause 14 in the <Track Info Priority Level> value; and

D. shall include the temporary identifier as the first <Floor Participant Reference> value;

3. if an active floor request queue exists, shall move the active floor request queue to a passive floor request queue; and

4. perform the actions in the subclause 6.5.4.

When receiving an indication from the application and signalling plane that an MCPTT client has joined the session, the floor participant interface shall perform the actions in subclause 6.5.5.

6.5.3 The MCPTT call release procedure in the non-Controlling MCPTT function of an MCPTT group

When an MCPTT client leaves an MCPTT call and the MCPTT call remains ongoing with the other MCPTT clients, the non-controlling MCPTT function of an MCPTT group follows a two-step procedure:

Step 1 The floor participant interface stops sending floor control messages and RTP media packets to the MCPTT client leaving the MCPTT call and the floor participant interface discards floor control messages and RTP media packets received from the MCPTT client leaving the MCPTT call; and

Step 2 When the application and signalling plane has determined that the session with this floor participant has been released, the corresponding instance of the 'floor participant state transition' state machine is released.

When an MCPTT call is released, the floor control server interface follows a two-step procedure:

Step 1 The floor control server interface stops sending floor control messages and RTP media packets to MCPTT clients in the MCPTT call; and

Step 2 When the application and signalling plane has determined that the MCPTT call has been released, resources in the floor control server interface are released, along with all 'floor participant state transition' state machines.

The non-controlling MCPTT function of an MCPTT group can initiate an MCPTT call release depending on the release policy specified in 3GPP TS 24.379 [2].

6.5.4 Floor control server interface procedures

6.5.4.1 General

The floor control server interface is stateless with regards to the floor control message received and sent.

The following subclauses specifies what the floor control server shall do when receiving a floor control message from the floor control server or from the floor participant interface and how the floor control server controls the media distributor in the non-controlling MCPTT function.

6.5.4.2 Receiving a Floor Request message

Upon receiving a Floor Request message from one floor participant interface, the floor control server interface:

1. shall send the Floor Request message to the floor control server. The Floor Request message:
   a. shall include all fields included by the floor participant;
   b. if a Track Info field is included, shall include the temporary identifier at the end of the <Floor Participant Reference> value item; and
   c. if a Track Info field is not included:
      i. shall include the "mc_queueing" fmtp attribute value negotiated as specified in clause 14 in the <Queueing Capability> value;
      ii. shall include a <Participant Type> value based on the <Participant Type> element specified in 3GPP TS 24.381 [12], if value in the <Participant Type> element is available, otherwise set the <Participant Type> value to '15' (unknown); and
      iii. shall include the temporary identifier as the first <Floor Participant Reference> value; and
2. if queueing was negotiated in the "mc_queueing" fmtp attribute, shall store the outgoing Floor Request message in the passive floor request queue.

6.5.4.3 Receive Floor Release message

Upon receiving a Floor Release message from one floor participant interface, the floor control server interface:

NOTE: A Floor Release message can be received from the permitted floor participant and from any participant that is queued in the floor control server.

1. shall send a Floor Release message to the floor control server. The Floor Release message:
   a. shall include all fields included by the floor participant in the Floor Release message;
   b. if a Track Info field is included, shall include the temporary identifier at the end of the <Floor Participant Reference> value item; and
   c. if a Track Info field is not included, shall include a Track Info field as follows:
      i. shall include the "mc_queueing" fmtp attribute value negotiated as specified in clause 14 in the <Queueing Capability> value;
      ii. shall include the "mc_priority" fmtp attribute value negotiated as specified in clause 14 in the <Track Info Priority Level> value; and
      iii. shall include the temporary identifier as the first <Floor Participant Reference> value; and
2. if a Floor Request message received from the floor participant is in the passive floor request queue, shall remove the floor request from the passive floor request queue.

6.5.4.4 Receive Floor Queue Position Request message

Upon receiving a Floor Queue Position Request message from one floor participant interface, the floor control server interface:

1. shall send the Floor Queue Position Request message to the floor control server. The Floor Queue Position Request message:
   a. shall include all fields included by the floor participant;
   b. if a Track Info field is included, shall include the temporary identifier at the end of the <Floor Participant Reference> value item; and
   c. if a Track Info field is not included, shall include a Track Info field as follows:

i. shall include the "mc_queueing" fmtp attribute value negotiated as specified in clause 14 in the <Queueing Capability> value;

ii. shall include the "mc_priority" fmtp attribute value negotiated as specified in clause 14 in the <Track Info Priority Level> value; and

iii. shall include the temporary identifier as the first <Floor Participant Reference> value.

6.5.4.5 Receive Floor Ack message

Upon receiving a Floor Ack message from one floor participant interface acknowledging a Floor Idle message, the floor control server interface:

1. if the floor control server interface is not waiting for any Floor Ack message (i.e. the Floor Ack message is already sent due to local policy to the floor control server), shall not continue with the rest of the steps;

2. if the floor control server interface is waiting for Floor Ack messages from floor participant interfaces and the conditions for sending the Floor Ack is not fulfilled yet, shall not continue with the rest of the steps; and

3. if the floor control server interface is waiting for Floor Ack messages from floor participant interfaces and the condition for sending the Floor Ack is now fulfilled, shall send the Floor Ack message towards the floor control server.

Upon receiving a Floor Ack message from one floor participant interface acknowledging a Floor Taken message, the floor control server interface:

1. if the floor control server interface is not waiting for any Floor Ack message (i.e. the Floor Ack message is already sent due to local policy to the floor control server), shall not continue with the rest of the steps;

2. if the floor control server interface is waiting for Floor Ack messages from floor participant interfaces and the conditions for sending the Floor Ack is not fulfilled yet, shall not continue with the rest of the steps; and

3. if the floor control server interface is waiting for Floor Ack messages from floor participant interfaces and the condition for sending the Floor Ack is now fulfilled, shall send the Floor Ack message as received towards the floor control server.

Upon receiving a Floor Ack message from one floor participant interface acknowledging a Floor Granted message, the floor control server interface:

1. shall send a Floor Ack message towards the floor control server. The Floor Ack message:

   a. shall include all received fields;

   b. if a Track Info field is included, shall include the temporary identifier associated with the floor participant interface at the end of the Track Info field; and

   c. if a Track Info field is not included, shall include a Track Info field as follows:

      i. shall include the "mc_queueing" fmtp attribute value negotiated as specified in clause 14 in the <Queueing Capability> value;

      ii. shall include the "mc_priority" attribute value negotiated as specified in clause 14 in the <Track Info Priority Level> value; and

      iii. shall include the temporary identifier as the first <Floor Participant Reference> value.

Upon receiving a Floor Ack message from one floor participant interface acknowledging a Floor Deny message, the floor control server interface:

1. shall send a Floor Ack message towards the floor control server. The Floor Ack message:

   a. shall include all received fields;

   b. if a Track Info field is included, shall include the temporary identifier associated with the floor participant interface at the end of the Track Info field; and

c. if a Track Info field is not included, shall include a Track Info field as follows:

i. shall include the "mc_queueing" fmtp attribute value negotiated as specified in clause 14 in the <Queueing Capability> value;

ii. shall include the "mc_priority" fmtp attribute value negotiated as specified in clause 14 in the <Track Info Priority Level> value; and

iii. shall include the temporary identifier as the first <Floor Participant Reference> value.

Upon receiving a Floor Ack message from one floor participant interface acknowledging a Floor Queue Position Info message, the floor control server interface:

1. shall send the Floor Ack message towards the floor control server. The Floor Ack message:

a. shall include all received fields;

b. if a Track Info field is included, shall include the temporary identifier associated with the floor participant interface at the end of the Track Info field; and

c. if a Track Info field is not included, shall include a Track Info field as follows:

i. shall include the "mc_queueing" fmtp attribute value negotiated as specified in clause 14 in the <Queueing Capability> value;

ii. shall include the "mc_priority" fmtp attribute value negotiated as specified in subclause 14 in the <Track Info Priority Level> value; and

iii. shall include the temporary identifier as the first <Floor Participant Reference> value.

Upon receiving a Floor Ack message from the floor control server acknowledging a Floor Release message, the floor control server interface:

1. shall use the <Participant Reference> value at the end of the Track Info field to identify the floor participant interface;

2. if:

a. the Track Info field only contains one <Participant Reference> value, shall remove the Track Info field from the outgoing Floor Granted message; and

b. if the Track Info field contains more than one <Participant Reference> value, shall remove the last <Participant Reference> value from the Track Info field; and

3. shall send the Floor Ack message to the floor participant interface.

6.5.4.6 Receive Floor Granted message

Upon receiving a Floor Granted message from the floor control server, the floor control server interface:

1. shall use the <Participant Reference> value at the end of the Track Info field to identify the floor participant interface;

2. if:

a. the Track Info field only contains one <Participant Reference> value, shall remove the Track Info field from the outgoing Floor Granted message; and

b. if the Track Info field contains more than one <Participant Reference> value, shall remove the last <Participant Reference> value from the Track Info field;

3. shall send a Floor Taken message to all participant interfaces with the exception of the floor participant interface to which the Floor Granted message is sent. The Floor Taken message:

a. shall include the granted MCPTT users MCPTT ID in the Granted Party's Identity field, if privacy is not requested by the granted floor participant when the MCPTT client was invited to the session;

NOTE: The privacy request was stored for each invited MCPTT client when the MCPTT client accepted the invitation as described in subclause 6.5.2.

b. shall increase the stored message sequence number value with 1, include the new value of the message sequence number in the Message Sequence Number field and then store the new value of the message sequence number;

c. shall include the Permission to Request Floor field to '0', if the group call is a broadcast group call; and

d. may include the Permission to Request the Floor field set to '1', if the group call is not a broadcast group call; and

4. if the Floor Request message received from the floor participant is in the passive floor request queue, shall remove the floor request from the passive floor request queue.

6.5.4.7 Receive Floor Deny message

Upon receiving a Floor Deny message from the floor control server, the floor control server interface:

1. shall use the <Participant Reference> value at the end of the Track Info field to identify the floor participant interface;

2. if:

a. the Track Info field only contains one <Participant Reference> value, shall remove the Track Info field from the outgoing Floor Granted message; and

b. if the Track Info field contains more than one <Participant Reference> value, shall remove the last <Participant Reference> value from the Track Info field;

3. shall forward the Floor Deny message to the floor participant interface; and

4. if the Floor Request message received from the floor participant is in the passive floor request queue, shall remove the floor request from the passive floor request queue.

6.5.4.8 Receive Floor Idle message

Upon receiving a Floor Idle message from the floor control server, the floor control server interface:

NOTE: The Floor Idle message can be either destined to floor participants in all MCPTT clients or is sent to the floor participant in a specific MCPTT client. In the latter case the Floor Idle message contains the Track Info field.

1. if the Floor Idle message contains a Track Info field;

a. shall use the <Participant Reference> value at the end of the Track Info field to identify the floor participant interface;

b. if:

i. the Track Info field only contains one <Participant Reference> value:

A. shall remove the Track Info field from the outgoing Floor Idle message;

B. shall increase the stored message sequence number value with 1; and

C. replace the received stored <Message Sequence Number> value in the Message Sequence Number field with the new value of the message sequence number and store the new message sequence number; and

ii. if the Track Info field contains more than one <Participant Reference> value, shall remove the last <Participant Reference> value from the Track Info field; and

c. shall send the Floor Idle message to the floor participant interface;

2. if the Floor Idle message does not contain a Track Info field;

a. shall send the Floor Idle message to all floor participant interfaces;

3. if the first bit in the subtype of the Floor Idle message is set to '1' (acknowledgement is required) as specified in subclause 8.2.2, based on local policy:

   a. shall send a Floor Ack message. The Floor Ack message:

      i. shall include the Source field set to '3' (the non-controlling MCPTT function is the source); and

   b. shall wait for Floor Ack messages from floor participants; and

4. shall empty the passive floor request queue.

6.5.4.9 Receive Floor Taken message

Upon receiving a Floor Taken message from the floor control server, the floor control server interface:

NOTE: The Floor Taken message can be either destined to floor participants in all MCPTT clients or is sent to the floor participant in a specific MCPTT client. In the latter case the Floor Taken message contains the Track Info field.

1. if the Floor Taken message contains a Track Info field;

   a. shall use the <Participant Reference> value at the end of the Track Info field to identify the floor participant interface;

   b. if the Track Info field only contains one <Participant Reference> value:

      A. shall remove the Track Info field from the outgoing Floor Taken message;

      B. shall increase the stored message sequence number value with 1;

      C. replace the received stored <Message Sequence Number> value in the Message Sequence Number field with the new value of the stored message sequence number; and

      D. store the new value of the stored message sequence number;

   c. if the Track Info field contains more than one <Participant Reference> value, shall remove the last <Participant Reference> value from the Track Info field; and

   d. shall send the Floor Taken message to the floor participant interface;

2. if the Floor Taken message does not contain a Track Info field;

   a. shall send the Floor Taken message to all floor participant interfaces; and

3. if the first bit in the subtype of the Floor Taken message is set to '1' (acknowledgement is required) as specified in subclause 8.2.2, based on local policy:

   a. shall send a Floor Ack message. The Floor Ack message:

      i. shall include the Source field set to '3' (the non-controlling MCPTT function is the source); and

   b. shall wait for Floor Ack messages from floor participants.

6.5.4.10 Receive Floor Revoke message

Upon receiving a Floor Revoke message from the controlling MCPTT function, the floor control server interface:

1. shall use the <Participant Reference> value at the end of the Track Info field to identify the floor participant interface;

2. if:

   a. the Track Info field only contains one <Participant Reference> value, shall remove the Track Info field from the outgoing Floor Granted message; and

b. if the Track Info field contains more than one <Participant Reference> value, shall remove the last <Participant Reference> value from the Track Info field; and

3. shall forward the Floor Revoke message to the floor participant interface.

6.5.4.11 Receive Floor Queue Position Info message

Upon receiving a Floor Queue Position Info message from the controlling MCPTT function, the non-controlling MCPTT function:

1. shall use the <Participant Reference> value at the end of the Track Info field to identify the floor participant interface;

2. if:

   a. the Track Info field only contains one <Participant Reference> value, shall remove the Track Info field from the outgoing Floor Granted message; and

   b. if the Track Info field contains more than one <Participant Reference> value, shall remove the last <Participant Reference> value from the Track Info field; and

3. shall forward the Floor Queue Position Info message to the floor participant interface.

6.5.4.12 Receive RTP media packets from controlling MCPTT function

Upon receiving an indication from the media distributor that RTP media packets are received from the controlling MCPTT function, the floor control server interface:

1. shall request the network media distributor to forward received RTP media packets to all MCPTT clients in the session controlled by the non-controlling MCPTT function where the SSRC of the received RTP media packets are different to SSRC used by an MCPTT client.

NOTE: If one of the MCPTT client controlled by the non-controlling MCPTT function is granted the floor, media originated from that MCPTT client is not distributed back to the MCPTT client granted the floor.

6.5.4.13 Receive RTP media packets from an MCPTT client

Upon receiving an indication from the media distributor that RTP media packets are received from one of the network interfaces, the floor control server interface:

1. shall request the network media distributor to forward received RTP media packets towards the controlling MCPTT function.

NOTE: If RTP media packets are received from an MCPTT client not permitted to send media, the floor participant interface will send a Floor Revoke message to the floor participant of the misbehaving MCPTT client without involving the floor control server interface.

6.5.4.14 MCPTT session release step 1

Upon receiving an MCPTT call release step 1 request from the application and signalling plane e.g. when the session is going to be released, the floor control interface:

1. shall ignore floor control message from the floor control server;

2. shall request the media distributor to stop distributing RTP media packets to the network media interface of the MCPTT clients; and

3. shall ignore any floor control messages received from the floor participant interfaces.

6.5.4.15 MCPTT session release step 2

Upon receiving an MCPTT call release step 2 request from the application and signalling plane, the floor control server interface:

1. shall release all resources associated with this session.

6.5.4.16 Receiving a split instruction (R: Split)

Upon receiving an instruction from the application and signalling plane to split the ongoing group session, the floor control server interface:

1. shall perform the actions in subclause 6.3.2.3.

6.5.5 Floor participant interface procedures

6.5.5.1 General

The floor participant interface shall behave according to the state diagram and state transitions specified in this subclause.

Figure 6.5.5.1-1 shows the general floor control operation states (P states) and the state transition diagram.

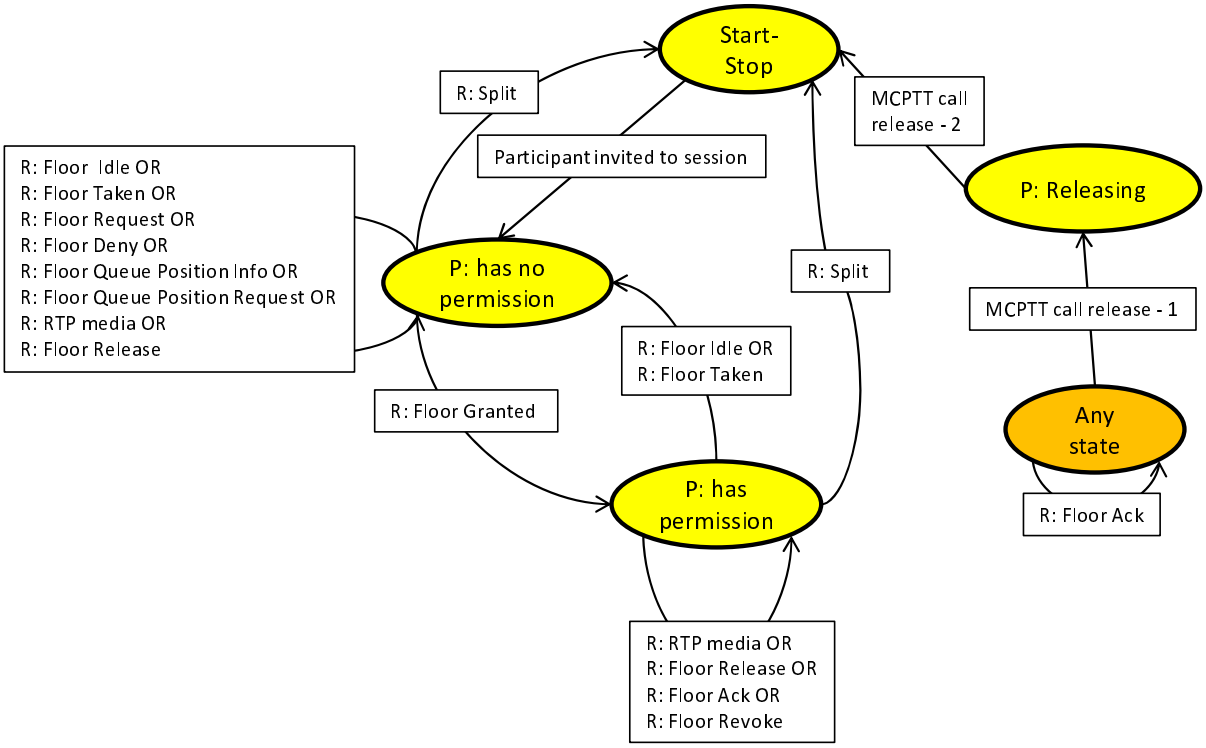


Figure 6.5.5.1-1: The 'floor participant interface state transition' state diagram

The floor participant interface shall keep one instance of the 'floor participant interface state transition' state machine per MCPTT client in a session.

The floor participant associated to the 'floor participant interface state transition' state machine is in the following subclauses referred to as the associated floor participant.

If floor control messages or RTP media packets arrives in a state where there is no procedure specified in the following subclauses the floor participant interface:

1. shall discard the floor control message;

2. shall request the network media interface to discard any received RTP media packet; and

3. shall remain in the current state.

State details are explained in the following subclauses.

6.5.5.2 State: 'Start-Stop'

6.5.5.2.1 General

When a new instance of the 'Floor participant interface state transition' state machine is initiated, before any floor control related input is applied, the state machine is in 'Start-stop' state. Similarly when the session is released the state machine shall return to the 'Start-stop' state.

6.5.5.2.2 Participant invited to session

When the floor participant receives an indication from the floor control server interface that an MCPTT client has accepted the invitation to a session (i.e. when the SIP 200 (OK) response to the initial SIP INVITE request is received as specified in 3GPP TS 24.379 [2]) , the floor participant interface:

1. shall enter the 'P: has no permission' state.

6.5.5.3 State: 'P: has no permission'

6.5.5.3.1 General

The floor participant interface uses this state when the associated floor participant is not permitted to send media.

6.5.5.3.2 Receive Floor Idle message (R: Floor Idle)

When the floor participant interface receives a Floor Idle message from the floor control server interface, the floor participant interface:

1. shall send the Floor Idle message to the floor participant;
2. if the first bit in the subtype of the Floor Idle message is set to '1' (acknowledgement is required) as specified in subclause 8.2.2, shall store that a Floor Ack message to a Floor Idle messages is expected; and
3. shall remain in the 'P: has no permission' state.

6.5.5.3.3 Receive Floor Taken message (R: Floor Taken)

When the floor participant interface receives a Floor Taken message from the floor control server interface, the floor participant interface:

1. shall send the Floor Taken message to the floor participant;
2. if the first bit in the subtype of the Floor Taken message is set to '1' (acknowledgement is required) as specified in subclause 8.2.2, shall store that a Floor Ack message to a Floor Taken messages is expected; and
3. shall remain in the 'P: has no permission' state.

6.5.5.3.4 Receive Floor Request message (R: Floor Request)

When the floor participant interface receives a Floor Request message from the floor participant, the floor participant interface:

1. shall send the Floor Request message to the floor control server interface; and
2. shall remain in the 'P: has no permission' state.

6.5.5.3.5 Receive Floor Granted message (R: Floor Granted)

When the floor participant interface receives a Floor Granted message from the floor control server interface, the floor participant interface:

1. shall send the Floor Granted message to the floor participant;
2. if the first bit in the subtype of the Floor Granted message is set to '1' (acknowledgement is required) as specified in subclause 8.2.2, shall store that a Floor Ack message to a Floor Granted messages is expected; and
3. shall enter the 'P: has permission' state.

6.5.5.3.6 Receive Floor Deny message (R: Floor Deny)

When the floor participant interface receives a Floor Deny message from the floor control server interface, the floor participant interface:

1. shall send the Floor Deny message to the floor participant;
2. if the first bit in the subtype of the Floor Deny message is set to '1' (acknowledgement is required) as specified in subclause 8.2.2, shall store that a Floor Ack message to a Floor Deny messages is expected; and
3. shall remain in the 'P: has no permission' state.

6.5.5.3.7 Receive Floor Queue Position Info message (R: Floor Queue Position Info)

When the floor participant interface receives a Floor Queue Position Info message from the floor control server interface, the floor participant interface:

1. shall send the Floor Queue Position Info message to the floor participant;
2. if the first bit in the subtype of the Floor Queue Position Info message is set to '1' (acknowledgement is required) as specified in subclause 8.2.2, shall store that a Floor Ack message to a Floor Queue Position Info messages is expected; and
3. shall remain in the 'P: has no permission' state.

6.5.5.3.8 Receive Floor Queue Position Request message (R: Floor Queue Position Request)

When the floor participant interface receives a Floor Queue Position Request message from the floor participant, the floor participant interface:

1. shall send the Floor Queue Position Request message to the floor control server interface; and
2. shall remain in the 'P: has no permission' state.

6.5.5.3.9 Receive RTP media packets (R: RTP media)

When the floor participant interface receives an indication from the network media interface that RTP media packets are received from the media distributor, the floor participant interface

1. shall instruct the media interface to received RTP media packets towards the MCPTT client; and
2. shall remain in the 'P: has no permission' state.

When the floor participant interface receives an indication from the network media interface that RTP media packets are received from the MCPTT client, the floor participant interface

1. shall send a Floor Revoke message to the floor participant. The Floor Revoke message:
   a. shall include the Reject Cause field with the <Reject Cause> value set to #3 (No permission to send a Media Burst);
2. shall store that a Floor Release message is expected from the floor participant; and

3. shall remain in the 'P: has no permission' state.

6.5.5.3.10 Receive Floor Release message (R: Floor Release)

When the floor participant interface receives a Floor Release message from the floor participant, the floor participant interface:

1. if a Floor Release message is not expected from the floor participant:
   a. if the first bit in the subtype of the Floor Release message is set to '1' (acknowledgement is required) as specified in subclause 8.2.2, based on local policy:
      i shall send a Floor Ack message to the floor participant and set the first bit in the subtype of the Floor Release message set to '0' (acknowledgement is not required) in the outgoing Floor Release message; or
      ii. wait for the Floor Ack from the floor control server; and
   b. shall forward the Floor Release message to the floor control server interface;
2. if a Floor Release message is expected from the floor participant:
   a. if the first bit in the subtype of the Floor Release message is set to '1' (acknowledgement is required) as specified in subclause 8.2.2:
      i. shall send a Floor Ack message to the floor participant; and
   b. shall remove that a Floor Ack message is expected to a Floor Release message; and
3. shall remain in the 'P: has no permission' state.

6.5.5.3.11 Receive split instruction (R: Split)

Upon receiving an instruction to split the ongoing MCPTT call, the interface to the floor participant:

1. shall create a new instance of the 'basic floor control operation towards the floor participant' state machine;
2. shall move information associated with the instance used for 'floor participant interface state transition' to the 'basic floor control operation towards the floor participant' state machine;

NOTE: Which information that needs to be moved is an implementation option.

3. shall enter the 'Start-stop' state and terminate the 'floor participant state transition' state machine associated with this floor participant and this session;
4. if the state in 'general floor control operation' state machine is 'G: Floor Idle' state; shall enter the 'U: not permitted and Floor Idle' state as specified in subclause 6.3.5.3.2; and
5. if the state in 'general floor control operation' state machine is 'G: Floor Taken' state; shall enter the 'U: not permitted and Floor Taken' state as specified in subclause 6.3.5.4.2.

6.5.5.4 State: 'P: has permission'

6.5.5.4.1 General

The floor participant interface uses this state when the floor participant has permission to send media

6.5.5.4.2 Receive RTP media packets

When the floor participant interface receives an indication from the network media interface that RTP media packets are received from the MCPTT client, the floor participant interface:

1. shall instruct the media interface to forward received RTP media packets towards the media distributor; and
2. shall remain in the 'P: has permission' state.

6.5.5.4.3 Receive Floor Release message

When the floor participant interface receives a Floor Release message from the floor participant, the floor participant interface:

1. shall send the Floor Release message to the floor control server interface; and

3. shall remain in the 'P: has permission' state.

6.5.5.4.4 Receive Floor Ack message

When the floor participant interface receives a Floor Ack message from the floor control server interface, the floor participant interface:

1. shall send the Floor Ack message to the floor participant; and

2. shall remain in the 'P: has permission' state.

6.5.5.4.5 Receive Floor Idle message

When the floor participant interface receives a Floor Idle message from the floor control server interface, the floor participant interface:

1. shall send the Floor Idle message to the floor participant;

2. if the first bit in the subtype of the Floor Idle message is set to '1' (acknowledgement is required), shall store that a Floor Ack message to a Floor Idle messages is expected; and

3. shall enter the 'P: has no permission' state.

6.5.5.4.6 Receive Floor Taken message

When the floor participant interface receives a Floor Taken message from the floor control server interface, the floor participant interface:

1. shall send the Floor Taken message to the floor participant;

2. if the first bit in the subtype of the Floor Taken message is set to '1' (acknowledgement is required), shall store that a Floor Ack message to a Floor Taken messages is expected; and

3. shall enter the 'P: has no permission' state.

6.5.5.4.7 Receive Floor Revoke message

When the floor participant interface receives a Floor Revoke message from the floor control server interface, the floor participant interface:

1. shall send the Floor Revoke message to the floor participant;

2. if the first bit in the subtype of the Floor Revoke message is set to '1' (acknowledgement is required), shall store that a Floor Ack message to a Floor Revoke messages is expected; and

3. shall remain in the 'P: has permission' state.

6.5.5.4.8 Receive split instruction (R: Split)

Upon receiving an instruction to split the ongoing MCPTT call, the interface to the floor participant:

1. shall create a new instance of the 'basic floor control operation towards the floor participant' state machine;

2. shall move information associated with the instance used for 'floor participant interface state transition' to the 'basic floor control operation towards the floor participant' state machine;

NOTE: Which information that needs to be moved is an implementation option.

3. shall enter the 'Start-stop' state and terminate the 'floor participant state transition' state machine associated with this floor participant and this session; and

4. shall enter the 'U: permitted' state as specified in subclause 6.3.5.5.2.

6.5.5.5 In any state

6.5.5.5.1 General

This subclause describes the actions to be taken in all states defined for the 'floor participant state transition' diagram with the exception of the 'Start-stop' and 'Releasing' states.

6.5.5.5.2 Receive Floor Ack message (R: Floor Ack)

If a Floor Ack message is received from the floor participant, the floor participant interface:

1. shall send the Floor Ack message to the floor control server interface indicating which message that the Floor Ack is an acknowledgment to; and

2. shall remain in the current state.

If a Floor Ack message is received from the floor control server interface, the floor participant interface:

1. shall send the Floor Ack message to the floor participant; and

2. shall remain in the current state.

6.5.5.5.3 MCPTT session release step 1 (MCPTT call release - 1)

Upon receiving an MCPTT call release step 1 request from the application and signalling plane e.g. when the session is going to be released or when the MCPTT client leaves the session, the floor participant interface:

1. shall stop sending floor control messages to the floor participant;

2. shall request the network media interface to stop sending RTP media packets towards to the MCPTT client;

3. shall ignore any floor control messages received from the floor participant;

4. shall request the network media interface to stop forwarding RTP media packets from the MCPTT client to the media distributor;

5. shall indicate to the floor control server interface that the MCPTT client has started to disconnect from the session; and

6. shall enter the 'P: Releasing' state.

6.5.5.6 State: 'P: Releasing'

6.5.5.6.1 General

The floor participant interface uses this state while waiting for the application and signalling plane to finalize the release of the session or finalizing the removal of the MCPTT client from the session.

6.5.5.6.2 MCPTT session release step 2 (MCPTT call release - 2)

Upon receiving an MCPTT call release step 2 request from the application and signalling plane, the floor participant interface:

1. shall request the network media interface to release all resources associated with this MCPTT client for this MCPTT call; and

2. shall enter the 'Start-stop' state and terminate the 'floor participant state transition' state machine associated with this floor participant and this session.

7 Off-network floor control

7.1 General

A floor control session may be initiated only if there is a successfully established off-network group call.

In off-network, floor control is performed using floor control messages among the MCPTT clients without a centralized floor arbitrator. When off-network, if a floor control session is active, the floor arbitrator and the floor participant are co-located in the MCPTT client (see 3GPP TS 23.179 [5]). During a floor control session the MCPTT client currently speaking serves as the temporary floor arbitrator. All other MCPTT clients in the call play the role of floor participant. When the floor arbitrator grants the floor to another MCPTT client, that new MCPTT client, when starts to send media, becomes the new floor arbitrator and the former (the MCPTT client which granted the floor) becomes a floor participant.

The procedures in subclause 7.2 are from the perspective of a single MCPTT client. No special message other than floor control messages and media is used for coordinating the floor arbitrator and floor participant status of the separate MCPTT clients participating in the off-network call.

The floor control messages are always sent to all the participants of the call. Therefore they can be monitored by any MCPTT client listening to the call.

In a floor control session queueing of floor requests may be supported.

It is assumed that the MCPTT user presses the PTT for requesting talk permission and it keeps it pressed until the request is resolved. If queueing of floor requests is not supported, this request is either granted or rejected or no answer is received. If the request is granted the user is notified with talk permission tone (or equivalent) and the user continues to press the PTT until it finishes the talk burst. If the request is rejected or no answer is received the user is notified and releases the PTT button.

If queueing of floor requests is supported, the MCPTT user shall be notified when a floor request is queued and the MCPTT user shall release the PTT button. When, after queueing, the floor is granted to this user the MCPTT user shall be informed that its queued request is now granted. Then it should press the PTT button within a short duration. Otherwise, the grant is taken from this MCPTT user. An MCPTT user can appear in a queue only once. The floor request queue is transferred from the former to the new floor arbitrator.

After the initiation of a floor control session the MCPTT client behaves according to the state machine presented in subclause 7.2.3. The state machine is designed such that in normal cases only one of the MCPTT clients, which participates the call, acts as floor arbitrator and all others act as floor participants. However, there may be situations such that more than one MCPTT client are at an internal state causing them to act as floor arbitrator. A short sequence of floor control messages and RTP media packets are initiated to resolve these situations.

7.2 Floor participant procedures

7.2.1 Floor participant procedures at MCPTT session initialization

This subclause applies when no active floor control session exists.

Before a floor control entity is initiated a state machine with a single state, named as 'O: Start-stop' state, shall exist. At 'O: Start-stop' state, when the MCPTT client receives a request of the MCPTT call control entity to initiate the floor control as originating client, then the MCPTT client shall initiate a floor control entity and the floor control entity shall enter into the 'O: has permission' state. Otherwise, if MCPTT client receives a request of the MCPTT call control entity to initiate the floor control as terminating client, then the MCPTT client shall initiate a floor control entity and the floor control entity shall enter into the 'O: has no permission' state.

Once the session is initiated, the initial floor control messages are sent according to the state machine presented in subclause 7.2.3. Normally, once the session is started the originating MCPTT client has the floor implicitly. For an on-going off-network group call, if an MCPTT client joins later, then it starts the floor control session and takes the role of floor participant and enters 'O: silence' state.

7.2.2 Floor participant procedures at MCPTT call release

This subclause applies when an active floor control session exists.

When the off-network group call is released the floor control session is terminated. The off-network floor control session can also be terminated when no media transmission or reception takes place during floor control session hold time T230 (during silence). The termination of the floor control session as a result of the expiry of timer T230 (during silence) does not terminate the call session.

7.2.3 Floor participant state diagram – basic operation

7.2.3.1 General

The floor participant shall behave according to the state diagram and the transitions specified in this subclause.

The received floor messages and the RTP media packets are inputs to the state machine according to their arrival order. They are not ignored unless otherwise stated.

The MCPTT client also provides input to the state machine as request to talk (press PTT button) or as end of talk (release PTT button).

Figure 7.2.3.1-1 show the 'Floor participant state diagram – basic operation'.

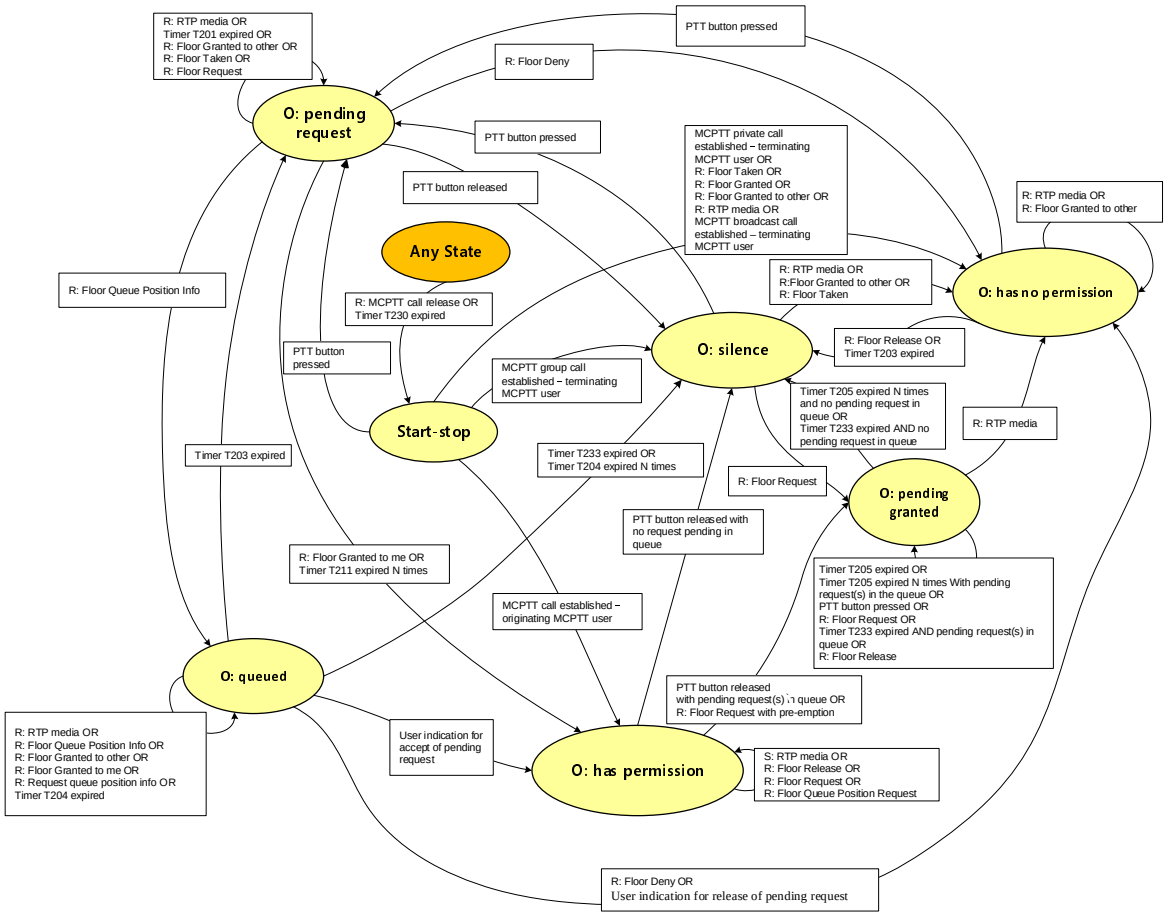


Figure 7.2.3.1-1: 'Floor participant state diagram – basic operation'

State details are explained in the following subclauses.

If an RTP media packet or a floor control message arrives in a state where there is no specific procedure specified for the RTP media packet or the received floor control message, the floor participant shall discard the floor control message or the RTP media packet and shall remain in the current state.

NOTE: A badly formatted RTP packet or floor control message received in any state is ignored by the floor participant and does not cause any change of the current state.

7.2.3.2 State: 'Start-stop'

7.2.3.2.1 General

When a new instance of the state machine is created, before any floor control related input is applied, the state machine is in the 'Start-stop' state. Similarly when the call is released the state machine shall return to the 'Start-stop' state.

7.2.3.2.2 MCPTT call established – originating MCPTT user

When an MCPTT call is established with session announcement including an explicit floor request, the originating floor participant:

1. shall create an instance of a floor participant state transition diagram for basic operation state machine;

2. shall send Floor Granted message towards other floor participants. The Floor Granted message:
   a. shall include the granted priority in the Floor priority field; and
   b. shall include the MCPTT user's own MCPTT ID in the User ID field; and
3. shall enter 'O: has permission' state.

7.2.3.2.3 MCPTT group call established – terminating MCPTT user

When an MCPTT call is established the terminating floor participant:

1. shall create an instance of a floor participant state transition diagram for basic operation state machine;
2. shall start timer T230 (during silence); and
3. shall enter 'O: silence' state.

7.2.3.2.4 MCPTT private call established – terminating MCPTT user

When an MCPTT private call is established the terminating floor participant:

1. shall create an instance of a floor participant state transition diagram for basic operation state machine;
2. shall start timer T230 (during silence);
3. shall start timer T203(end of RTP media); and
4. shall enter 'O: has no permission' state.

7.2.3.2.5 Send Floor Request message (PTT button pressed)

If the floor participant receives an indication from the MCPTT user to send media, the floor participant:

1. shall create an instance of a floor participant state transition diagram for basic operation state machine;
2. shall start timer T230 (during silence);
3. shall send the Floor Request message to other floor participants. The Floor Request message:
   a. if a different priority than the normal priority is required, shall include the Floor Priority field with the requested priority in the <Floor Priority> value; and
   b. shall include the MCPTT ID of the MCPTT user in the <User ID> value of the User ID field;
4. shall start the timer T201 (Floor request); and
5. shall enter 'O: pending request' state.

7.2.3.2.6 Receive Floor Taken message (R: Floor Taken)

When a Floor Taken message is received, the floor participant:

1. shall create an instance of a floor participant state transition diagram for basic operation state machine;
2. shall start timer T230 (during silence);
3. may provide a floor taken notification to the MCPTT user;
4. shall set the stored SSRC of the current arbitrator to the SSRC of user to whom the floor was granted in the Floor Taken message;
5. shall start timer T203 (end of RTP media); and
6. shall enter 'O: has no permission' state.

7.2.3.2.7 Receive Floor Granted message (R: Floor Granted to other)

When a Floor Granted message is received and if the User ID in the Floor Granted message does not match its own User ID, the floor participant:

1. shall create an instance of a floor participant state transition diagram for basic operation state machine;
2. shall start timer T230 (during silence);
3. may provide a floor taken notification to the MCPTT user;
4. shall set the stored SSRC of the current arbitrator to the SSRC of user to whom the floor was granted in the Floor Granted message;
5. shall start timer T203 (end of RTP media); and
6. shall enter 'O: has no permission' state.

7.2.3.2.8 Receive RTP media (R: RTP media)

Upon receiving RTP media packets, the floor participant:

1. shall create an instance of a floor participant state transition diagram for basic operation state machine;
2. shall start timer T230 (during silence);
3. may provide a floor taken notification to the MCPTT user;
4. shall set the stored SSRC of the current arbitrator to the SSRC of RTP media packet;
5. shall start timer T203 (end of RTP media);
6. shall request the MCPTT client to start rendering received RTP media packets; and
7. shall enter 'O: has no permission' state.

7.2.3.2.9 MCPTT broadcast call established – terminating MCPTT user

When an MCPTT private call is established the terminating floor participant:

1. shall create an instance of a floor participant state transition diagram for basic operation state machine;
2. shall start timer T203 (end of RTP media);
3. shall start timer T230 (during silence); and
4. shall enter 'O: has no permission' state.

NOTE: In MCPTT broadcast call, only originating MCPTT user is allowed to request floor and transmit media. A Floor Request message is locally denied to terminating MCPTT user, if requested.

7.2.3.3 State: 'O: silence'

7.2.3.3.1 General

In this state a none of the MCPTT clients in the session is acting as a floor control server.

7.2.3.3.2 Send Floor Request message (PTT button pressed)

If the floor participant receives an indication from the MCPTT user to send media, the floor participant:

1. shall send the Floor Request message to other floor participants. The Floor Request message:

a. if a different priority than the normal priority is required, shall include the Floor Priority field with the requested priority in the <Floor Priority> value with a value not exceeding the configured value of the <priority-hierarchy> specified in 3GPP TS 24.384 [13];

b. shall include the MCPTT ID of the MCPTT user in the <User ID> value of the User ID field; and

c. if the floor request is a broadcast group call, system call, emergency call or an imminent peril call, shall include a Floor Indicator field indicating the relevant call types;

2. shall start timer T201 (Floor Request); and

3. shall enter 'O: pending request' state.

7.2.3.3.3 Receive RTP media (R: RTP media)

Upon receiving RTP media packets and if there is no stored SSRC of the current arbitrator, the floor participant:

1. may provide a floor taken notification to the MCPTT user;

2. shall restart timer T230 (during silence);

3. shall set the stored SSRC of the current arbitrator to the SSRC of RTP media packet;

4. shall restart (or start, if not running already) timer T203 (end of RTP media);

5. shall request the MCPTT client to start rendering received RTP media packets; and

6. shall enter 'O: has no permission' state.

Otherwise, if SSRC of floor participant sending the media matches the stored SSRC of current arbitrator, the floor participant:

1. shall restart (or start, if not running already) timer T203 (end of RTP media);

2. shall restart timer T230 (during silence);

3. shall request the MCPTT client to start rendering received RTP media packets; and

4. shall enter 'O: has no permission' state.

7.2.3.3.4 Receive Floor Granted message (R: Floor Granted to other)

When a Floor Granted message is received and if the User ID in the Floor Granted message does not match its own User ID, the floor participant:

1. may provide a floor taken notification to the MCPTT user;

2. if the Floor Indicator field is included and the B-bit is set to '1' (Broadcast group call), shall provide a notification to the user indicating that this is a broadcast group call;

3. shall set the stored SSRC of the current arbitrator to the SSRC of user to whom the floor was granted in the Floor Granted message;

4. shall start timer T203 (end of RTP media); and

5. shall enter 'O: has no permission' state.

7.2.3.3.5 Receive Floor Request message (R: Floor Request)

The transition is used in private call only. When a Floor Request message is received, the floor participant:

1. shall send a Floor Granted message toward the other floor participant. The Floor Granted message:

a. shall include the MCPTT ID of the Floor Request message received in User ID value of the User ID field;

b. shall include the SSRC of the Floor Request message received in the SSRC of floor control server field;

c. shall include the max duration as configured in the MCPTT client in the OffNetwork/MaxDuration parameter in the <Duration> value of the Duration field; and

d. shall include the priority of the Floor Request message received in the <Floor Priority> value of the Floor Priority field;

2. shall start timer T205 (Floor Granted); and

3. shall enter 'O: pending granted' state.

7.2.3.3.6 Receive Floor Taken message (R: Floor Taken)

When a Floor Taken message is received, the floor participant:

1. may provide a floor taken notification to the MCPTT user;

2. shall set the stored SSRC of the current arbitrator to the SSRC of user to whom the floor was granted in the Floor Taken message;

3. shall start timer T203 (end of RTP media); and

4. shall enter 'O: has no permission' state.

7.2.3.4 State: 'O: has no permission'

7.2.3.4.1 General

In this state the MCPTT client does not have permission to send media.

7.2.3.4.2 Sending Floor Request message (PTT button pressed)

If the floor participant receives an indication from the MCPTT user that the MCPTT user wants to send media, the floor participant:

1. shall send the Floor Request message to other clients. The Floor Request message:

   a. if a different priority than the normal priority is required, shall include the Floor Priority field with the requested priority in the <Floor Priority> value with a value not exceeding the configured value of the <priority-hierarchy> specified in 3GPP TS 24.384 [13];

   b. shall include the MCPTT ID of the MCPTT user in the User ID field; and

   c. if the floor request is a broadcast group call, system call, emergency call or an imminent peril call, shall include a Floor Indicator field indicating the relevant call types;

2. shall start timer T201 (Floor Request); and

3. shall enter 'O: pending request' state.

7.2.3.4.3 Receive Floor Release message (R: Floor Release)

When a Floor Release message is received and if the SSRC in the Floor Release message matches the SSRC in the last RTP media packet received, the floor participant:

1. shall request the MCPTT client to stop rendering received RTP media packets;

2. shall stop timer T203 (end of RTP media);

3. shall clear the stored SSRC of the current arbitrator;

4. shall enter 'O: silence' state; and

5. may provide floor idle notification to the MCPTT user.

7.2.3.4.4 Timer T13 (end of RTP media) expired

On expiry of T13 (No RTP Media) timer, the floor participant:

1. shall request the MCPTT client to stop rendering received RTP media packets;
2. shall clear the stored SSRC of the current arbitrator;
3. shall enter 'O: silence' state; and
4. may provide floor idle notification to the MCPTT user.

7.2.3.4.5 Receive Floor Granted message (R: Floor Granted to other)

When a Floor Granted message is received and if the <User ID> value in the User ID field does not match its own MCPTT ID and SSRC of floor participant sending the Floor Granted message matches the stored SSRC of current arbitrator, the floor participant:

1. shall request the MCPTT client to stop rendering received RTP media packets;
2. shall restart timer T203 (end of RTP media);
3. shall set the stored SSRC of the current arbitrator to the SSRC of user to whom the floor was granted in the Floor Granted message;
4. may provide a floor taken notification to the MCPTT user;
5. if the Floor Indicator field is included with the B-bit set to '1' (Broadcast group call), shall provide a notification to the user indicating that this is a broadcast group call; and
6. shall remain in the 'O: has no permission' state.

7.2.3.4.6 Receive RTP media (R: RTP media)

Upon receiving RTP media packets and if there is no stored SSRC of the current arbitrator, the floor participant:

1. shall request the MCPTT client to render the received RTP media packets;
2. shall set the stored SSRC of the current arbitrator to the SSRC of RTP media packet;
3. shall restart timer T230 (During silence);
4. shall restart timer T203 (end of RTP media); and
5. shall remain in 'O: has no permission' state.

Otherwise, if SSRC of floor participant sending the media matches the stored SSRC of current arbitrator, the floor participant:

1. shall request the MCPTT client to render the received RTP media packets;
2. shall restart timer T230 (during silence);
3. shall restart timer T203 (end of RTP media); and
4. shall remain in 'O: has no permission' state.

7.2.3.5 State: 'O: has permission'

7.2.3.5.1 General

In this state the MCPTT client is acting as a floor control server and has the permission to send media.

7.2.3.5.2 Send RTP Media packets (S: RTP Media)

Upon receiving encoded media from the user or if encoded media is already buffered the floor participant:

1. shall request the MCPTT client to start sending RTP media packets towards other MCPTT clients; and
2. shall remain in 'O: has permission' state.

7.2.3.5.3 Receive Floor Release message (R: Floor Release)

Upon receiving a Floor Release message, the floor participant:

1. shall remove the sender of the Floor Release message from the queue, if the <User ID> value in the floor release message matches the <User ID> value of the queued request; and
2. shall remain in 'O: has permission' state.

7.2.3.5.4 Receive Floor Request message (R: Floor Request)

When a Floor Request message is received in a session where:

1. queueing of floor requests is not used; or
2. queueing of floor requests is used but a Floor Indicator field indicating that queueing of floor requests is supported is not included in the Floor Request message;

then the floor participant:

1. shall send the Floor Deny message. The Floor Deny message:
   a. shall include in the Reject Cause field the <Reject Cause> value cause #1 (Another MCPTT client has permission);
   b. may include in the Reject Cause field an additional text string explaining the reason for rejecting the floor request in the <Reject Phrase> value; and
   c. shall include the User ID field received in the Floor Request message; and
2. shall remain in 'O: has permission' state.

When a Floor Request message is received in a session where queueing of floor requests is used and if the priority in the Floor Priority field of the message is not higher, the floor participant:

1. shall store the received Floor Request messages;
2. if the pending request queue is not full, shall send the Floor Queue Position Info message. The Floor Queue Position Info message:
   a. shall include in the User ID field the MCPTT ID of the floor participant sending the Floor Request message;
   b. shall include the SSRC of the floor participant in the SSRC of queued floor participant field;
   c. shall include the position in the floor request queue in the Queue Info field; and
   d. shall include the floor priority in the Queue Info field;
3. if the pending request queue is full, shall send the Floor Deny message. The Floor Deny message:
   a. shall include in the Reject Cause field the <Reject Cause> value cause #7 (Queue full);
   b. may include in the Reject Cause field an additional text string explaining the reason for rejecting the floor request in the <Reject Phrase> value; and
   c. shall include the User ID field received in the Floor Request message; and
4. shall remain in 'O: has permission' state.

7.2.3.5.5 Send Floor Release message (PTT button released with no pending request in queue)

Upon receiving an indication from the MCPTT user to release permission to send RTP media, the floor participant:

1. shall send a Floor Release message towards other floor participants, if no queued requests exist: The Floor Release message:
   a. shall include the MCPTT ID of the MCPTT user in the User ID field; and
   b. if the session is not initiated as a broadcast group call with the B-bit set to '1' (Broadcast group call), shall include a Floor Indicator field set to '0' (normal call);
2. shall start timer T230 (during silence);
3. shall clear the stored SSRC of the current arbitrator; and
4. shall enter 'O: silence' state.

7.2.3.5.6 Send Floor Granted message (PTT button released with pending request(s) in queue)

When no more encoded media is received from the user and if at least one Floor Request message is stored (i.e. queueing mode is used in the session), the floor participant:

1. shall request the MCPTT client to stop sending RTP media packets towards other MCPTT clients;
2. shall send the Floor Granted message toward the other floor participants. For each floor participant in the queue, the Floor Granted message:
   a. shall include the MCPTT ID of the floor participant in the Queued User ID field;
   b. shall include the SSRC of the floor participant in the SSRC of queued floor participant field;
   c. shall include the queue position of the floor participant in the Queue Info field;
   d. shall include the priority of the floor participant in the Queue Info field; and
   e. if the floor request is a broadcast group call, system call, emergency call or an imminent peril call, shall include a Floor Indicator field indicating the relevant call types;
3. shall set the stored SSRC of the current arbitrator to the SSRC of user to whom the floor was granted in the Floor Granted message;
4. shall start timer T205 (Floor Granted) and shall initiate counter C25 (Floor Granted) to 1;
5. shall start timer T230 (during silence); and

6 shall enter the 'O: pending granted' state.

7.2.3.5.7 Receive Floor Request message with pre-emption indication (R: Floor Request with pre-emption)

When a Floor Request message is received and determined, as described in subclause 4.1.1.3, to be of a higher priority than the floor participant with a pre-emption priority higher than priority of the floor participant, the floor participant:

1. shall request the MCPTT client to stop sending RTP media packets towards other MCPTT clients;
2. shall send a Floor Granted message;
3. shall start timer T205 (Floor Granted) and shall initiate counter C25 (Floor Granted) to 1;
4. if floor control queueing mode is used in the session, for each floor participant in the queue the Floor Granted message:
   a. shall include the MCPTT ID of the floor participant in the Queued User ID field;

b. shall include the SSRC of the floor participant in the SSRC of queued floor participant field;

c. shall include the queue position of the floor participant in the Queue Info field; and

d. shall include the priority of the floor participant in the Queue Info field;

5. shall start timer T230 (during silence); and

6. shall enter the 'O: pending granted' state.

7.2.3.5.8 Receive Floor Queue Position Request message (R: Floor Queue Position Request)

Upon receiving a Floor Queue Position Request message, the floor participant:

1. shall send the Floor Queue Position Info message. The Floor Queue Position Info message:

   a. shall include the MCPTT ID of the queued floor participant in the Queued User ID field;

   b. shall include the queue position and floor priority in the Queue Info field;

   c. shall include the SSRC of floor participant sending Floor Queue Position Request message in SSRC of queue floor participant field; and

   d. shall include the User ID of floor participant sending Floor Queue Position Request message in User ID field; and

2. remain in the 'O: has permission' state.

7.2.3.6 State: 'O: pending request'

7.2.3.6.1 General

In this state the MCPTT client is waiting for a response to a Floor request message.

In this state timer T201 (Floor Request) is running.

To resolve race condition between multiple simultaneous floor requests, the MCPTT client resets the counter associated with timer T201, if another floor request with higher priority or higher SSRC, in case the priority is same, is received.

7.2.3.6.2 Receive RTP media (R: RTP media)

Upon receiving RTP media packets and if there is no stored SSRC of the current arbitrator, the floor participant:

1. shall request the MCPTT client to render the RTP media packets;

2. shall reset the counter associated with timer T201 (Floor Request);

3. shall set the stored SSRC of the current arbitrator to the SSRC of RTP media packet;

4. shall restart timer T230 (during silence);

5. shall restart (or start, if not running already) timer T203 (end of RTP media); and

6. shall remain in 'O: pending request' state.

Otherwise, if SSRC of floor participant sending the media matches the stored SSRC of current arbitrator, the floor participant:

1. shall request the MCPTT client to render the RTP media packets;

2. shall reset the counter associated with timer T201 (Floor Request);

3. shall restart timer T230 (during silence);

4. shall restart (or start, if not running already) timer T203 (end of RTP media); and
5. shall remain in 'O: pending request' state.

7.2.3.6.3 Receive Floor Queue Position Info message (R: Floor Queue Position Info)

Upon receiving Floor Queue Position Info message, the floor participant:

1. shall update the queue status, if the <User ID> value in the User ID field matches its own MCPTT ID;
2. may notify the MCPTT user about the queue position received in the <Queue position info> value in the Queue Info field;
3. shall stop timer T201 (Floor Request); and
4. shall enter 'O: queued' state.

7.2.3.6.4 Receive Floor Deny message (R: Floor Deny)

Upon receiving Floor Deny message, the floor participant:

1. shall stop the timer T201 (Floor Request), if the <User ID> value in the User ID field matches its own MCPTT ID;
2. shall provide floor deny notification to the user;
3. may display the floor deny reason to the user using information in the Reject Cause field; and,
4. shall enter 'O: has no permission' state.

7.2.3.6.5 Send Floor Release message (PTT button released)

When an indication from the MCPTT user to release the pending request for the floor is received, the floor participant:

1. shall send a Floor Release message towards other floor participants. The Floor Release message:
   a. shall include the MCPTT ID of the MCPTT user in the <User ID> value of the User ID field; and
   b. if the session is not initiated as a broadcast group call with the B-bit set to '1' (Broadcast group call), shall include a Floor Indicator field set to '0' (normal call);
2. shall stop the timer T201 (Floor Request);
3. shall clear the stored SSRC of the current arbitrator; and
4. shall enter 'O: silence' state.

7.2.3.6.6 Send Floor Taken message (Timer T11 expired N times)

On the N^{th} expiry of timer T201 (Floor Request), the floor participant:

1. shall send the Floor Taken message toward the other floor participants. The Floor Taken message:
   a. shall include the own SSRC in the SSRC field;
   b. shall include the own MCPTT ID in the User ID field; and
   c. if the floor request is a broadcast group call, system call, emergency call or an imminent peril call, shall include a Floor Indicator field indicating the relevant call types;
2. shall stop timer T203 (end of RTP media), if running;
3. shall stop timer T230 (during silence), if running; and
4. shall enter 'O: has permission' state.

7.2.3.6.7 Receive Floor Granted message (R: Floor Granted to me)

Upon receiving Floor Granted message and if the <User ID> value in the User ID field matches its own MCPTT ID and SSRC of floor participant sending the Floor Granted message matches the stored SSRC of current arbitrator, the floor participant:

1. shall request the MCPTT client to stop rendering received RTP media packets;
2. shall stop timer T203 (end of RTP media), if running;
3. shall stop timer T201 (Floor Request);
4. shall stop timer T230 (during silence), if running;
5. may provide a floor granted notification to the MCPTT user;
6. if the Floor Indicator field is included and the B bit is set to '1' (Broadcast group call), shall provide a notification to the user indicating the type of call; and
7. shall enter 'O: has permission' state.

7.2.3.6.8 Receive Floor Granted message (R: Floor Granted to other)

Upon receiving a Floor Granted message and if the <User ID> value in the User ID field does not match its own MCPTT ID and SSRC of floor participant sending the Floor Granted message matches the stored SSRC of current arbitrator, the floor participant:

1. shall request the MCPTT client to stop rendering received RTP media packets;
2. shall set the stored SSRC of the current arbitrator to the SSRC of user to whom the floor was granted in the Floor Granted message;
3. shall reset the counter associated with timer T201 (Floor Request);
4. shall restart timer T203 (end of RTP media);
5. shall re-start timer T201 (Floor Request);
6. may provide a floor taken notification to the MCPTT user;
7. if the Floor Indicator field is included and the B bit is set to '1' (Broadcast group call), shall provide a notification to the user indicating the type of call; and
8. shall remain in 'O: pending request' state.

7.2.3.6.9 Timer T201 (Floor Request) expired (Timer T201 expired)

On expiry of timer T201 (Floor Request), the floor participant:

1. shall send the Floor Request message to other floor participants. The Floor Request message:
   a. if a different priority than the normal priority is required, shall include the Floor Priority field with the requested priority in the <Floor Priority> value not exceeding the configured value of the <priority-hierarchy> specified in 3GPP TS 24.384 [13];
   b. shall include the MCPTT ID of the own MCPTT user in the User ID field; and
   c. if the floor request is a broadcast group call, system call, emergency call or an imminent peril call, shall include a Floor Indicator field indicating the relevant call types;
2. shall restart the timer T201 (Floor Request); and
3. shall remain in the 'O: pending request' state.

7.2.3.6.10 Receive Floor Request message (R: Floor request)

Upon receiving Floor Request message, if the priority of received request is higher than priority of the floor participant or if the SSRC of received request is higher, if the priority is same, the floor participant:

1. shall reset the counter associated with timer T11 (request re-send);
2. shall re-start timer T201 (Floor Request); and
3. shall remain in 'O: pending request' state.

7.2.3.6.11 Receive Floor Taken message (R: Floor Taken)

Upon receiving a Floor Taken message, the floor participant:

1. shall set the stored SSRC of the current arbitrator to the SSRC of user to whom the floor was granted in the Floor Granted message;
2. shall reset the counter associated with timer T201 (Floor request);
3. shall re-start timer T201 (Floor request); and
4. shall remain in 'O: pending request' state.

7.2.3.7 State: 'O: pending granted'

7.2.3.7.1 General

In this state the MCPTT client is waiting for another client to take over the role of floor controller.

The timer T205 (Floor Granted) is running in this state.

7.2.3.7.2 Receive RTP media (R: RTP Media)

Upon receiving the RTP media and the SSRC of RTP media packet matches with the stored SSRC of current arbitrator, the floor participant:

1. shall request the MCPTT client to render the received RTP media packets;
2. shall stop timer T205 (Floor Granted), if running;
3. shall stop timer T233 (pending user action), if running;
4. shall restart timer T230 (during silence);
5. shall start timer T203 (end of RTP media); and
6. shall enter 'O: has no permission' state.

7.2.3.7.3 Timer T205 (Floor Granted) expired (timer T205 expired)

On expiry of timer T205 (Floor Granted) and counter C25 (Floor Granted) is less than the upper limit, the floor participant:

1. shall send again the Floor Granted message toward the other floor participants. For each participant in the queue the Floor Granted message:
    a. shall include the MCPTT ID of the floor participant in the Queued User ID field;
    b. shall include the SSRC of the floor participant in the SSRC of queued floor participant field;
    c. shall include the queue position of the floor participant in the Queue Info field; and
    d. shall include the priority of the floor participant in the Queue Info field;

2. shall restart timer T205 (Floor Granted) and shall increment counter C25 (Floor Granted) by 1; and
3. shall remain in 'O: pending granted' state.

7.2.3.7.4 Timer T205 (Floor Granted) expired N times with pending request(s) in the queue (Timer T205 expired N times AND pending request(s) in queue)

On the expiry of timer T25 (Granted re-send for off-network) for the configured upper limit of C25 (Granted re-send for off-network) with request pending in the queue, the floor participant:

1. shall reset counter C205 (Floor Granted);
2. shall start the timer T233 (pending user action); and
3. shall remain in 'O: pending granted' state.

7.2.3.7.5 Timer T205 (Floor Granted request) expired N times with no pending request in the queue (Timer T205 expired N times AND no pending request in queue)

On the expiry of timer T205 (Floor Granted request) for a configurable number of times with no request pending in the queue, the floor participant:

1. shall reset the count of N;
2. shall clear the stored SSRC of the current arbitrator; and
3. shall enter 'O: silence' state.

7.2.3.7.6 Timer T233 (pending user action) expires with no pending request in the queue (Timer T233 expires AND no pending request in queue)

On expiry of timer T233 (pending user action) with no request pending in the queue, the floor participant:

1. shall send a Floor Release message towards other floor participants. The Floor Release message:
   a. shall include the MCPTT ID of the MCPTT user in the User ID field;
2. shall clear the stored SSRC of the current arbitrator; and
3. shall enter 'O: silence' state.

7.2.3.7.7 Timer T233 (pending user action) expires with pending request(s) in the queue (Timer T233 expired AND pending request(s) in queue)

On the expiry of timer T233 (pending user action) with more request(s) pending in the queue, the floor participant:

1. shall send the Floor Granted message for the next pending request in the queue towards other floor participants. For each participant in the queue the Floor Granted message:
   a. shall include the MCPTT ID of the floor participant in the Queued User ID field;
   b. shall include the SSRC of the floor participant in the SSRC of queued floor participant field;
   c. shall include the queue position of floor participant in the Queue Info field;
   d. shall include the priority of the floor participant in the Queue Info field; and
   e. if the floor request is a broadcast group call, system call, emergency call or an imminent peril call, shall include a Floor Indicator field indicating the relevant call types;
2. shall set the stored SSRC of the current arbitrator to the SSRC of user to whom the floor was granted in the Floor Granted message;
3. shall start timer T205 (Floor Granted) and shall initiate counter C205 (Floor Granted) to 1; and

4. shall remain in 'O: pending granted' state.

7.2.3.7.8 PTT button pressed

If the floor participant receives an indication from the MCPTT user to send media, the floor participant:

1. may notify the MCPTT user about rejection; and,
2. shall remain in 'O: pending granted' state.

Upon receiving a Floor Release message, the floor participant:

1. shall remove the sender of the Floor Release message from the queue, if the <User ID> value in the floor release message matches a queued request with the same <User ID> value; and
2. shall remain in 'O: pending granted' state.

7.2.3.7.9 Receive Floor Release message (R: Floor Release)

Upon receiving a Floor Release message, the floor participant:

1. shall remove the sender of the Floor Release message from the queue, if the User ID in the floor release message matches the queued request of User ID; and
2. shall remain in 'O: pending granted' state.

7.2.3.7.10 Receive Floor Request message (R: Floor Request)

When a Floor Request message is received, the floor participant:

1. shall send the Floor Deny message toward the other floor participant. The Floor Deny message:
   a. shall include in the Reject Cause field the <Reject Cause> value cause #1 (Another MCPTT client has permission);
   b. may include in the Reject Cause field an additional text string explaining the reason for rejecting the floor request in the <Reject Phrase> value; and
   c. shall include the User ID field received in the Floor Request message; and
2. shall remain in "O: pending granted" state.

7.2.3.8 State: 'O: queued'

7.2.3.8.1 General

In this state the MCPTT client is waiting for a response to a pending request.

7.2.3.8.2 Receive RTP media (R: RTP media)

Upon receiving RTP media packets and the SSRC of RTP media packet matches with the stored SSRC of current arbitrator, the floor participant:

1. shall request the MCPTT client to render the RTP media packets;
2. shall restart timer T230 (during silence);
3. shall restart timer T203 (end of RTP media); and
4. shall remain in 'O: queued' state.

7.2.3.8.3 Receive Floor Queue Position Info message (R: Floor Queue Position Info)

Upon receiving Floor Queue Position Info message, the floor participant:

1. shall update the queue position, if the <User ID> value in the User ID field matches its own MCPTT ID;
2. may notify the MCPTT user about the queue position received in the <Queue position info> value in the Queue Info field;
3. shall stop timer T204 (Floor Queue Position request); and
4. shall remain in 'O: queued' state.

7.2.3.8.4 Receive Floor Deny message (R: Floor Deny)

Upon receiving Floor Deny message, the floor participant:

1. shall stop the timer T233 (pending user action), if running;
2. shall provide floor deny notification to the user;
3. may display the floor deny reason to the user using information in the Reject Cause field; and,
4. shall enter 'O: has no permission' state.

7.2.3.8.5 User indication for release of pending request

When an indication from the MCPTT user to release the pending request for the floor is received, the floor participant:

1. shall send a Floor Release message towards other floor participants. The Floor Release message:
   a. shall include the MCPTT ID of the MCPTT user in the User ID field;
2. shall stop timer T233 (pending user action), if running; and
3. shall enter 'O: has no permission' state.

7.2.3.8.6 Receive Floor Granted message (R: Floor Granted to me)

Upon receiving Floor Granted message and if the <User ID> value in the User ID field matches its own MCPTT ID and SSRC of floor participant sending the Floor Granted message matches the stored SSRC of current arbitrator, the floor participant:

1. shall request the MCPTT client to stop rendering received RTP media packets;
2. shall start timer T233(pending user action);
3. may notify the MCPTT user about of the floor grant;
4. if the Floor Indicator field is included, and the B bit is set to '1' (Broadcast group call), shall provide a notification to the user indicating the type of call; and
5. shall remain in 'O: queued' state.

7.2.3.8.7 Timer T233 (pending user action) expires

1. shall enter 'O: silence' state.

7.2.3.8.8 User indication for accept of pending request

If the floor participant receives an indication from the user that the user wants to send media and the timer T233 (pending user action) is running, the floor participant:

1. shall stop the timer T233 (pending user action);

2. shall stop timer T230 (during silence), if running; and
3. shall enter 'O: has permission' state.

7.2.3.8.9 Receive Floor Granted message (R: Floor Granted to other)

Upon receiving Floor Granted message and if the <User ID> value in the User ID field does not match its own MCPTT ID and SSRC of floor participant sending the Floor Granted message matches the stored SSRC of current arbitrator, the floor participant:

1. shall request the MCPTT client to stop rendering received RTP media packets;
2. shall restart timer T203 (end of RTP media);
3. shall set the stored SSRC of the current arbitrator to the SSRC of user to whom the floor was granted in the Floor Granted message; and
4. shall remain in 'O: queued' state.

7.2.3.8.10 Timer T203 (end of RTP media) expires

On expiry of timer T203 (end of RTP media), the floor participant:

1. shall request the MCPTT client to stop rendering received RTP media packets;
2. shall send the Floor Request message to other floor participants. The Floor Request message:
   a. if a different priority than the normal priority is required, shall include the Floor Priority field with the requested priority in the <Floor Priority> value not exceeding the configured value of the <priority-hierarchy> specified in 3GPP TS 24.384 [13];
   b. shall include the MCPTT ID in the <User ID> value; and
   c. if the floor request is a broadcast group call, system call, emergency call or an imminent peril call, shall include a Floor Indicator field indicating the relevant call types;
3. shall start timer T201 (Floor Request);
4. shall clear the stored SSRC of the current arbitrator; and
5. shall enter 'O: pending request' state.

7.2.3.8.11 Send Floor Queue Position Request message (R: Request queue position info)

Upon receipt of an indication from the MCPTT client to request the queue position information, the floor participant:

1. shall send the Floor Queue Position Request message; The Floor Queue Position Request message:
   a. shall include the SSRC of sent Floor Request message in SSRC of floor participant field; and
   b. shall include the own MCPTT User ID in User ID field;
2. shall start timer T204 (Floor Queue Position request); and
3. remain in the 'O: queued' state.

7.2.3.8.12 Timer T204 (Floor Queue Position request) expires

Upon expiry of timer T204 (Floor Queue Position request), the floor participant:

1. shall send the Floor Queue Position Request message; The Floor Queue Position Request message:
   a. shall include the SSRC of sent Floor Request message in SSRC of floor participant field; and
   b. shall include the own MCPTT User ID in User ID field;

2. shall start timer T204 (Floor Queue Position request); and
3. remain in the 'O: queued' state.

7.2.3.8.13 Timer T204 (Floor Queue Position request) expires N times

Upon expiry of timer T204 (Floor Queue Position request) for upper limit of counter C204 times, the floor participant:

1. shall reset the count of associated counter;
2. shall clear the stored SSRC of the current arbitrator; and
3. shall enter 'O: silence' state.

7.2.3.9 In any state

7.2.3.9.1 General

This subclause describes the actions to be taken in all states defined for the basic state diagram with the exception of the 'Start-stop' state.

7.2.3.9.2 Receive MCPTT call release (R: MCPTT call release)

Upon receiving an MCPTT call release request from the application and signalling plane when the MCPTT call is going to be released, the floor participant:

1. shall stop sending floor control messages towards other floor participants;
2. shall request the MCPTT client to stop sending and receiving RTP media packets;
3. shall release all resources including any running timers associated with the MCPTT call;
4. shall terminate the instance of floor participant state transition diagram; and
5. shall enter 'Start-stop' state.

7.2.3.9.3 Timer T230 (during silence) expired (Timer T230 expired)

Upon expiry of timer T230 (during silence), the floor participant:

1. shall terminate the instance of floor participant state transition diagram; and
2. shall enter 'Start-stop' state.

8 Coding

8.1 Introduction

8.1.1 General

The media plane control protocols specified in this document are based on the RTCP Application Packets (RTCP: APP), as defined in IETF RFC 3550 [3], but the media plane control messages do not conform to the rules for compound RTCP packets or RTCP packet transmission.

Each media plane control message shall be one RTCP: APP packet. These RTCP: APP packets shall not be sent in compound RTCP packets, but more than one media plane control message may be sent in a single IP packet.

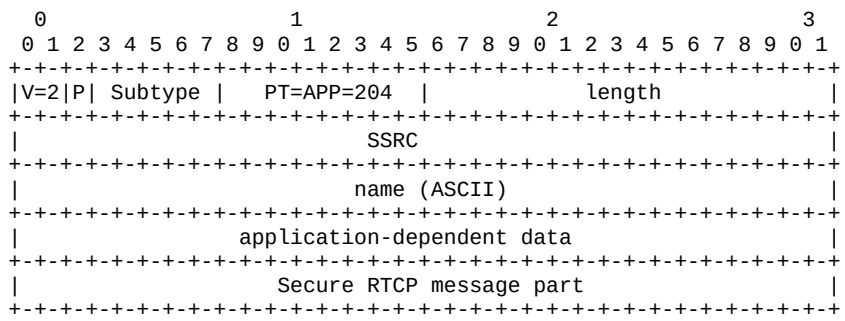
The three first 32-bit words in any of the media plane control protocols defined in this document are structured in a general way. The general structure of media plane control messages are described in subclause 8.1.2.

8.1.2 RTCP: APP message format

The definition of the fields in the RTCP APP packet is found in IETF RFC 3550 [3].

Table 8.1.2-1 shows the RTCP APP packet format.

Table 8.1.2-1: RTCP: APP message format



P

The padding bit P shall be set to '0'.

Subtype:

Any of the message types in table 8.2.2-1.

Length

The length field in the RTCP header is the length of the packet in 32-bit words, not counting the first 32-bit word in which the length field resides.

NOTE: The length field can indicate message size longer than specified in this version of the protocol. This can be the case e.g. if message is of later version of this protocol.

Name

The 4-byte ASCII string in the RTCP header shall be used to define the set of media plane control messages to be unique with respect to other APP packets that the media plane might receive.

The present document specified the use of the following names:

1. For the floor control protocol specified in present document the ASCII name string shall be: MCPT (Mission Critical Push-to-Talk).

2. For the pre-established session call control protocol specified in present document the ASCII name string shall be: MCPC (Mission Critical Pre-established session Control).

3. For the MBMS subchannel control protocol specified in present document the ASCII name string shall be: MCMC (Mission Critical MBMS subchannel Control).

Application-dependent data

The use of application dependent data is specified in the following subclauses. If the length of the application dependent data is not a multiple of 4 bytes, the application dependent data shall be padded to a multiple of 4 bytes. The value of the padding bytes should be set to zero. The receiver of padding bytes in a message shall ignore the value of the padding bytes.

This part is encrypted if SRTCP is used.

Secure RTCP message part

The content of the secure RTCP message part is in specified in clause 13 and in IETF RFC 3711 [16].

8.2 Floor control

8.2.1 Introduction

The floor control messages shall be coded as described in subclause 8.1.2 where the floor control message is part of the application-dependent data.

For the floor control protocol the ASCII name string shall be: MCPT (Mission Critical Push-to-Talk).

A list of floor control messages can be found in subclause 8.2.2.

The same floor control messages are used for on-network, off-network floor control and over the MBMS subchannel control channel.

NOTE: In case of off-network, the floor participant that has the floor acts as the floor control server in the following subclauses.

The floor control specific fields are specified in subclause 8.2.3.

8.2.2 Floor control messages

The table 8.2.2-1 provides a list of floor control messages.

Table 8.2.2-1: Floor control specific messages

Message name	Subtype	Reference	Direction
Floor Request	00000	Subclause 8.2.4	Client → server
Floor Granted	x0001	Subclause 8.2.5	Server → client
Floor Deny	x0011	Subclause 8.2.6	Server → client
Floor Release	x0100	Subclause 8.2.7	Client → server
Floor Idle	x0101	Subclause 8.2.8	Server → client
Floor Taken	x0010	Subclause 8.2.9	Server → client
Floor Revoke	00110	Subclause 8.2.10	Server → client
Floor Queue Position Request	01000	Subclause 8.2.11	Client → server
Floor Queue Position Info	x1001	Subclause 8.2.12	Server → client
Floor Ack	01010	Subclause 8.2.13	Server → client Client → server
NOTE: The floor control server is the server and the floor participant is the client.			

For some messages the first bit (marked as x in the subtype) can be used to indicate if the sender wants to have an acknowledgment. The x is coded as follows:

0 Acknowledgment is not required

1 Acknowledgment is required

NOTE: Whether a message needs to be acknowledged or not is described in clauses 6.

If an acknowledgment is required the Floor Ack message is used to acknowledge the message.

8.2.3 Floor control protocol specific fields

8.2.3.1 Introduction

This subclause describe fields specific for the floor control protocol.

The floor control messages can include floor control protocol specific fields contained in the application-dependent data of the floor control message.

Each floor control protocol specific field consists of an 8-bit field ID, an 8-bit octet length value describing the length of the field value not including the field ID or length value. Table 8.2.3.1-1 shows the floor control specific field structure.

Table 8.2.3.1-1: Floor control protocol specific field structure

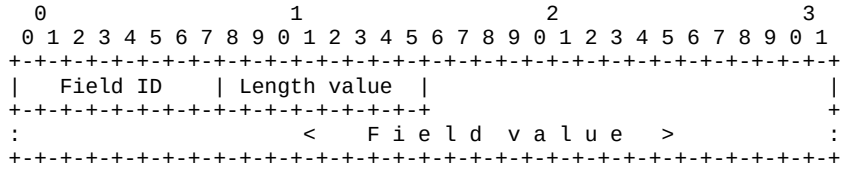


Table 8.2.3.1-2 lists the available fields including the assigned field ID.

Table 8.2.3.1-2: Floor control specific fields

Field name	Field ID		Reference
	Decimal	Binary	
-	000-099		IETF RFC 3550 [3] (NOTE)
Floor Priority	102	01100110	Subclause 8.2.3.2
Duration	103	01100111	Subclause 8.2.3.3
Reject Cause	104	01101000	Subclause 8.2.3.4
Queue Info	105	01101001	Subclause 8.2.3.5
Granted Party's Identity	106	01101010	Subclause 8.2.3.6
Permission to Request the Floor	108	01101100	Subclause 8.2.3.7
User ID	109	01101101	Subclause 8.2.3.8
Queue Size	110	01101110	Subclause 8.2.3.9
Message Sequence-Number	111	01101111	Subclause 8.2.3.10
Queued User ID	112	01110000	Subclause 8.2.3.11
Source	113	01110001	Subclause 8.2.3.12
Track Info	114	01110010	Subclause 8.2.3.13
Message Type	115	01110011	Subclause 8.2.3.14
Floor Indicator	116	01110100	Subclause 8.2.3.15
NOTE: The value range 000 – 099 is used by RTCP.			

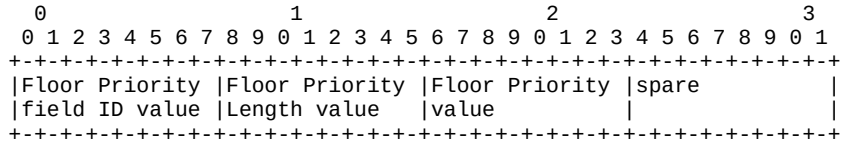
The following subclauses describe the coding of each field.

8.2.3.2 Floor Priority field

The Floor Priority field describes the level of priority a floor request is granted to use. The max floor priority that can be requested in a Floor Request message is negotiated between the MCPTT client and the controlling MCPTT function using the "mc_queueing" fmtp parameter as specified in clause 14.

Table 8.2.3.2-1 describes the coding of the Floor Priority field.

Table 8.2.3.2-1: Floor Priority field coding



The <Floor Priority field ID> value is a binary value and shall be set according to table 8.2.3.1-2.

The <Floor Priority length> value shall is a binary value indicating the length in octets of the <Floor priority> value item.

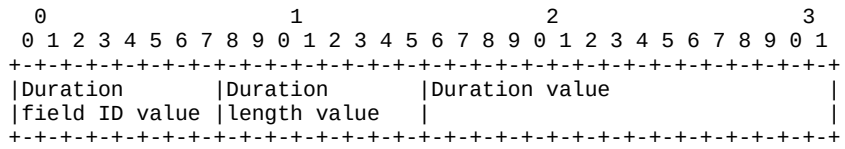
The <Floor Priority> value shall consist of 16 bit parameter giving the floor priority ('0' to '7') where '7' is the lowest priority and '0' is the highest priority. Whether the floor priority is pre-emptive or not is determine by the floor control server as described in subclause 4.1.1.3.

8.2.3.3 Duration field

The Duration field describes the time in seconds for which the granted party is allowed to transmit.

Table 8.2.3.3-1 describes the coding of the Duration field.

Table 8.2.3.3-1: Duration field coding



The <Duration field ID> value is a binary value and shall be set according to table 8.2.3.1-2.

The <Duration length> value is a binary value and shall have the value 2 indicating the total length in octets of the <Duration> value item.

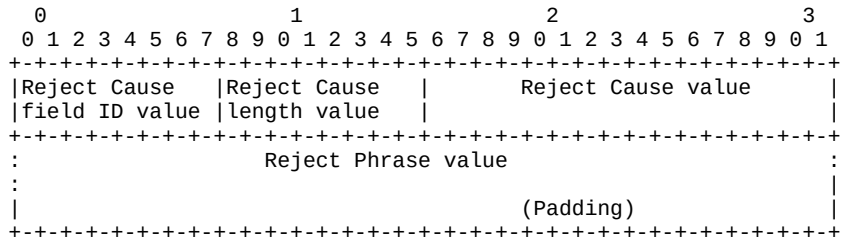
The <Duration> value is a binary value in seconds.

8.2.3.4 Reject Cause field

The Reject Cause field shall contain a <Reject Cause> value and may contain a <Reject Phrase> value. The content of the <Reject Cause> value is floor control message dependent and is described per individual floor control message carrying the Reject Cause field.

Table 8.2.3.4-1 describes the coding of the Reject Cause field.

Table 8.2.3.4-1: Reject Cause field coding



The <Reject Cause field ID> value is a binary value and shall be set according to table 8.2.3.1-2.

The <Reject Cause length> value is a binary value and shall indicate the total length in octets of the <Reject Cause > value and the <Reject Phrase> value items excluding any padding octets. If the length field is set to 2, there is no <Reject Phrase> value in the Reject Cause field.

The <Reject Cause> value is a 16 bit binary value.

The <Reject Phrase> value is a text string encoding as a text string in the SDES item CNAME as specified in IETF RFC 3550 [3].

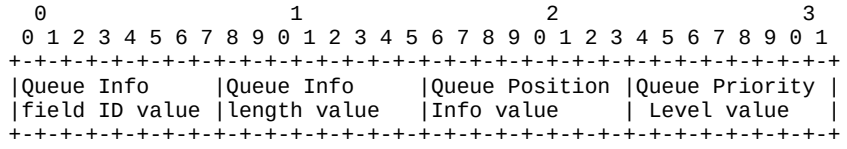
If the length of the <Reject Cause> value is not a multiple of 4 bytes, the Reject Cause field shall be padded to a multiple of 4 bytes. The value of the padding bytes should be set to zero. The padding bytes shall be ignored.

8.2.3.5 Queue Info field

The Queue Info field includes information about the position for one MCPTT client in the floor request queue and the priority of the floor request.

Table 8.2.3.5-1 describes the coding of the Queue Info field.

Table 8.2.3.5-1: Queue Info field coding



The <Queue Info field ID> value is a binary value and shall be set according to table 8.2.3.1-2.

The <Queue Info length> value is a binary value and shall have the value '2' indicating the total length in octets of the <Queue position info> value and the <Queue Priority Level> value items.

The <Queue Position Info> value is a binary value. It shall have value 65534 if the MCPTT client is not queued. It shall have the max value (65535) if the MCPTT client is queued but the MCPTT server is unable to determine the queue position or if MCPTT server policy is not to release information of the queue position to the MCPTT client.

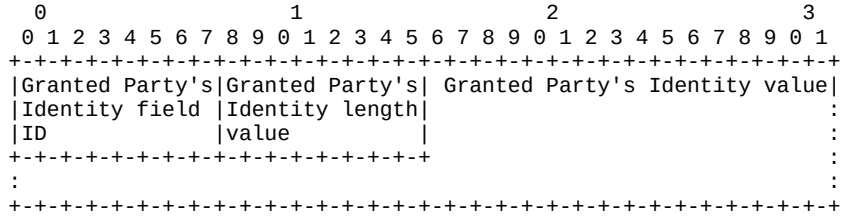
The <Queue Priority Level> value is coded as the <Floor Priority> value in subclause 8.2.3.2.

8.2.3.6 Granted Party's Identity field

The Granted Party's Identity field identifies the MCPTT user that is granted to send media.

Table 8.2.3.6-1 describes the coding of the Granted Party's Identity field.

Table 8.2.3.6-1: Granted Party's Identity field coding



The <Granted Party's Identity field ID> value is a binary value and shall be set according to table 8.2.3.1-2.

The <Granted Party's Identity length> value is coded as the <User ID length> value in subclause 8.2.3.8.

The <Granted Party's Identity> value is coded as the <User ID> value in subclause 8.2.3.8.

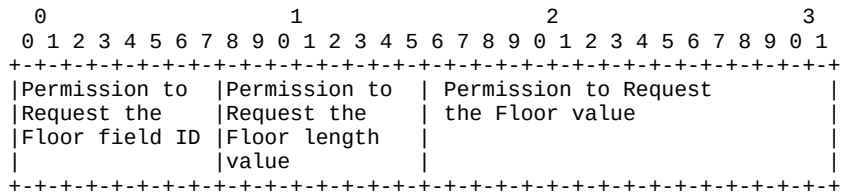
If the length of the <Granted Party's> value is not a multiple of 4 bytes, the Granted Party's Identity field shall be padded to a multiple of 4 bytes. The value of the padding bytes should be set to zero. The padding bytes shall be ignored.

8.2.3.7 Permission to Request the Floor field

The Permission to Request the Floor field indicates whether receiving parties are allowed to request the floor or not.

Table 8.2.3.7-1 describes the coding of the Permission to Request the Floor field.

Table 8.2.3.7-1: Permission to Request the Floor field coding



The <Permission to Request the Floor field ID> value is a binary value and shall be set according to table 8.2.3.1-2.

The <Permission to Request the Floor length> value is a binary value and shall have the value '2' indicating the total length in octets of the <Duration> value item.

The <Permission to Request the Floor> value is binary and coded as follows:

0 The receiver is not permitted to request floor.

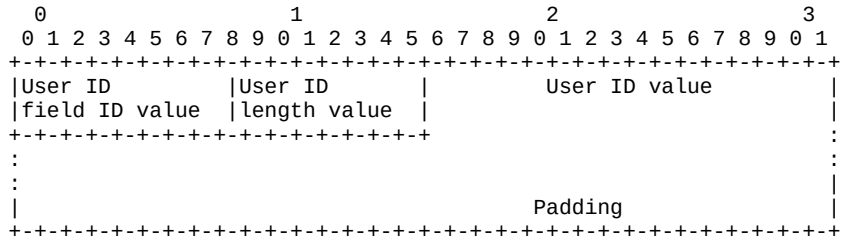
1 The receiver is permitted to request floor.

8.2.3.8 User ID field

The User ID field contains the MCPTT ID of an MCPTT user.

Table 8.2.3.8-1 describes the coding of the User ID field.

Table 8.2.3.8-1: User ID field coding



The <User ID field ID> value is a binary value and shall be set according to table 8.2.3.1-2.

The <User ID length> value is a binary value and shall include the value indicating the length in octets of the <User ID> value item except padding.

The <User ID> value is coded as described in table 8.2.3.8-2.

Table 8.2.3.8-2: ABNF syntax of string values of the <User ID> value

```
user-id = SIP-URI
```

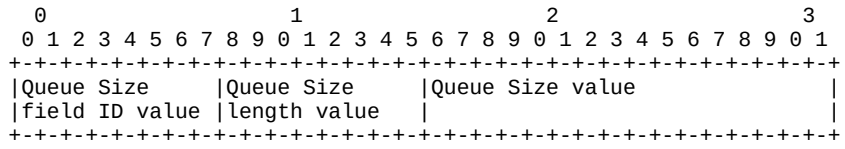
If the length of the <User ID> value is not a multiple of 4 bytes User ID field shall be padded to a multiple of 4 bytes. The value of the padding bytes should be set to zero. The floor control client shall ignore the value of the padding bytes.

8.2.3.9 Queue Size field

The Queue Size field contains the numbers of queueing MCPTT clients in an MCPTT call.

Table 8.2.3.9-1 describes the coding of the Queue size field.

Table 8.2.3.9-1: Queue Size field coding



The <Queue Size field ID> value is a binary value and shall be set according to table 8.2.3.1-2.

The <Queue Size length> value is a binary value and shall have the value '2' indicating the total length in octets of the <Queue Size> value item.

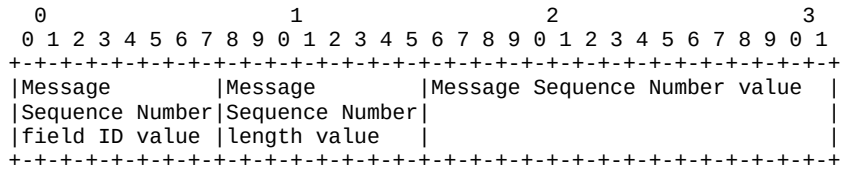
The <Queue Size> value is a binary value.

8.2.3.10 Message Sequence Number field

The Message Sequence Number field is used to bind a number of Floor Taken or bind a number of Floor Idle messages together.

Table 8.2.3.10-1 describes the coding of the Message Sequence Number field.

Table 8.2.3.10-1: Message Sequence Number field coding



The <Message Sequence Number field ID> value is a binary value and shall be set according to table 8.2.3.1-2.

The <Message Sequence Number length> value is a binary value and shall have the value 2 indicating the total length in octets of the <Message Sequence Number> value item.

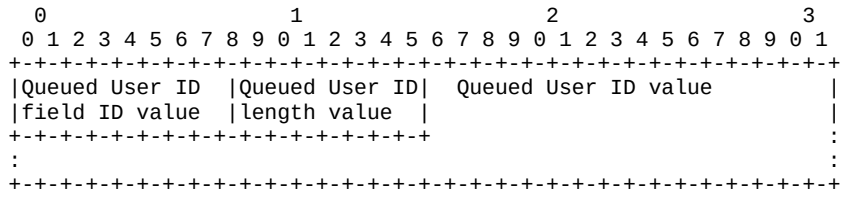
The <Message Sequence Number> value is a binary value. The <Message Sequence Number> value can be between '0' and '65535'. When the '65535' value is reached, the <Message Sequence Number> value starts from '0' again.

8.2.3.11 Queued User ID field

The Queued User ID field includes information about the identity of a queued MCPTT user.

Table 8.2.3.11-1 describes the coding of the Queued User ID field.

Table 8.2.3.11-1: Queued User ID field coding



The <Queued User ID field ID> value is a binary value and shall be set according to table 8.2.3.1-2.

The <Queued User ID length> value is coded as the <User ID length> value in subclause 8.2.3.8.

The <Queued User ID> value is coded as the <User ID> value in subclause 8.2.3.8.

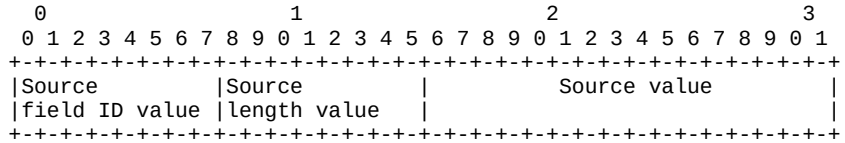
If the length of the <Queue User ID> value is not a multiple of 4 bytes, the Queue User ID field shall be padded to a multiple of 4 bytes. The value of the padding bytes should be set to zero. The padding bytes shall be ignored.

8.2.3.12 Source field

The Source field contains the source of the message.

Table 8.2.3.12-1 describes the coding of the Source field.

Table 8.2.3.12-1: Source field coding



The <Source field ID> value is a binary value and shall be set according to table 8.2.3.1-2.

The <Source length> value is a binary value and shall have the value 2 indicating the total length in octets of the <Source> value item.

The <Source> value is a 16 bit binary value where:

0 the floor participant is the source

1 the participating MCPTT function is the source

2 the controlling MCPTT function is the source

3 the non-controlling MCPTT function is the source

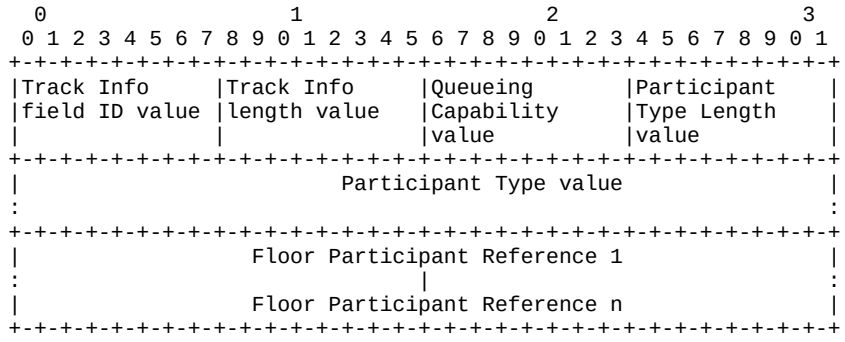
All other values are reserved for future use.

8.2.3.13 Track Info field

The Track Info field contains the path a floor control message has been routed along with the priority and the queueing capability of the MCPTT client.

Table 8.2.3.13-1 describes the coding of the Track Info field.

Table 8.2.3.13-1: Track Info field coding



The <Track Info field ID> value is a binary value and shall be set according to table 8.2.3.1-2.

The <Track Info length> value is a binary value and shall have a value indicating the total length in octets of the <Queueing Capability> value, <Track Info Priority Level> value and one or more <Floor Participant Reference> value items.

The <Queueing Capability> value is an 8 bit binary value where:

0 the floor participant in the MCPTT client do not support queueing

1 the floor participant in the MCPTT client do not support queueing

All other values are reserved for future use.

The spare bits are reserved for future use and shall be set to zero. The spare bits shall be ignored.

The <Participant Type Length> value is 8 bit binary value set to the length of the <Participant Type> value.

The <Participant Type> value is string coded as specified in table 8.2.3.13-2:

Table 8.2.3.13-2: ABNF syntax of values of the <Participant Type> value

```
participant-type = 1*( %x20-7E / UTF8-NONASCII )
```

If the length of the <Participant> value is not a multiple of 4 bytes, the Track Info field shall be padded to a multiple of 4 bytes. The value of the padding bytes should be set to zero. The padding bytes shall be ignored.

NOTE 1: The content of the <Participant Type> value is MCPTT service provider specific and out of scope of the present document.

All other values are reserved for future use.

The <Floor Participant Reference> value is a 32 bit binary value containing a reference to the floor participant in the non-Controlling function of an MCPTT group.

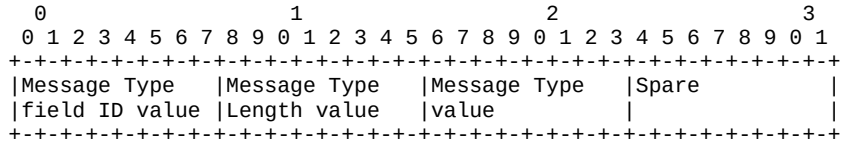
NOTE 2: The reference to the floor participant is a value only understandable by the floor control server interface in the non-Controlling function of an MCPTT group.

8.2.3.14 Message Type field

The Message Type field contains the floor control message name that is acknowledged.

Table 8.2.3.14-1 describes the coding of the Message Type field.

Table 8.2.3.14-1: Message Type field coding



The <Message Type field ID> value is a binary value and shall be set according to table 8.2.3.1-2.

The <Message Type Length> value is a binary value and shall have the value 2.

The <Message Type> value is an 8 bit binary value containing the binary value of the message type as coded in table 8.2.3.1-2.

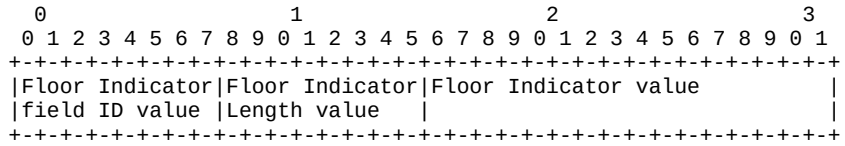
All other values are reserved for future use.

8.2.3.15 Floor Indicator field

The Floor Indicator contains additional information about a received floor message.

Table 8.2.3.15-1 describes the coding of the Floor Indicator field.

Table 8.2.3.15-1: Floor Indicator field coding

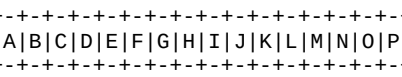


The <Floor Indicator field ID> value is a binary value and shall be set according to table 8.2.3.1-2.

The <Floor Indicator Length> value is a binary value and shall have the value '2'.

The <Floor Indicator> value is a 16 bit bit-map named as shown in table 8.2.3.15-2:

Table 8.2.3.15-2: Floor Indicator bit marking



When set to 1, the bit has the following meaning:

A = Normal call

B = Broadcast group call

C = System call

D = Emergency call

E = Imminent peril call

NOTE: The indicators C, D and E are only informative. There are no procedures specified for the C, D and E indicators in this release of the present document and the use of the indicators are implementation specific.

Bits F to P are reserved for future use and shall be set to 0.

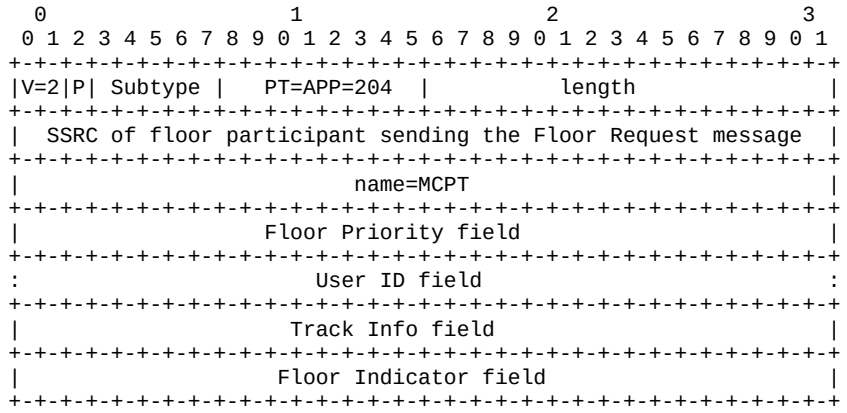
There can be more than one bit set to 1 at the same time. The local policy in the floor control server decides which combinations are possible and the priority of the indications.

8.2.4 Floor Request message

The Floor Request message is a request from a floor participant to get permission to send media. The Floor Request message can be used in the off-network mode and in the on-network mode. In the on-network mode the Floor Request message can only be sent on the unicast bearer.

Table 8.2.4-1 shows the content of the Floor Request message.

Table 8.2.4-1: Floor Request message



With the exception of the three first 32-bit words the order of the fields are irrelevant.

Subtype:

The subtype shall be coded according to table 8.2.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the floor participant sending the Floor Request message.

The content of the SSRC field shall be coded as specified in IETF RFC 3550 [3].

Floor priority:

The Floor Priority field shall be coded as described in subclause 8.2.3.2.

User ID:

The User ID field is used in off-network only and shall be coded as described in subclause 8.2.3.8.

Track Info:

The Track Info field shall be included when an MCPTT call involves a non-controlling MCPTT function. The coding of the Track Info field is described in subclause 8.2.3.13.

Floor Indicator:

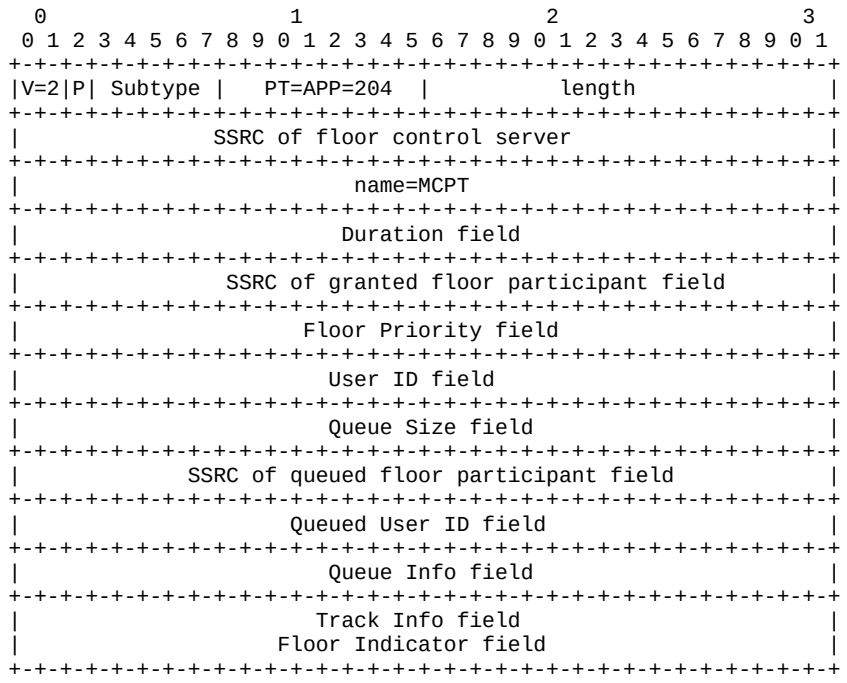
The Floor Indicator field shall be coded as described in subclause 8.2.3.15.

8.2.5 Floor Granted message

The Floor Granted message is an action from the floor control server to inform the requesting floor participant that it has been granted the permission to send media. The Floor Granted message can be used in the off-network mode and in the on-network mode. In the on-network mode the Floor Request message can only be sent on the unicast bearer.

Table 8.2.5-1 shows the content of the Floor Granted message.

Table 8.2.5-1: Floor Granted message



With the exception of the three first 32-bit words the order of the fields are irrelevant. However, any set of Queue size field, SSRC of queued floor participant field, Queued User ID field and the Queue Info field shall be kept together.

Subtype:

The subtype shall be coded according to table 8.2.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the floor control server.

The content of the SSRC field shall be coded as specified in IETF RFC 3550 [3].

Duration:

The Duration field is only applicable in on-network and shall be coded as specified in subclause 8.2.3.3.

SSRC of granted floor participant:

The SSRC of granted floor participant is only applicable in off-network.

The content of the SSRC of granted floor participant shall be coded as the SSRC specified in IETF RFC 3550 [3].

Floor Priority:

The Floor Priority field contains the granted floor priority and shall be coded as specified in subclause 8.2.3.2.

User ID:

The User ID field is used in off-network only. It shall carry the MCPTT ID of the floor participant granted the floor. The User ID field shall be coded as described in subclause 8.2.3.8.

Queue Size:

The Queue Size field is only applicable in off-network and contains the numbers of waiting MCPTT clients in the MCPTT call.

The Queue Size field shall be coded as specified in subclause 8.2.3.9.

For each waiting floor participant the following set of fields are included:

1. the SSRC of queued floor participant;
2. the Queued User ID field; and
3. the Queue info field.

The set shall occur as many times as the <Queue size> value in the Queue size field.

SSRC of queued floor participant:

The SSRC of queued floor participant is only applicable in off-network and shall carry the SSRC of the floor participant in the queue.

The content of the SSRC of queued floor participant shall be coded as the SSRC specified in IETF RFC 3550 [3].

Queued User ID:

The Queued User ID field is only applicable in off-network and contains the MCPTT ID of the floor participant in the queue.

The Queued User ID field shall be coded as specified in subclause 8.2.3.11.

Queue Info:

The Queue Info field is only applicable in off-network and defines the queue position and granted floor priority in the queue.

The Queue Info field shall be coded as specified in subclause 8.2.3.5.

Track Info:

The Track Info field shall be included when an MCPTT call involves a non-Controlling function. The coding of the Track Info field is described in subclause 8.2.3.13.

Floor Indicator:

The Floor Indicator field shall be coded as described in subclause 8.2.3.15.

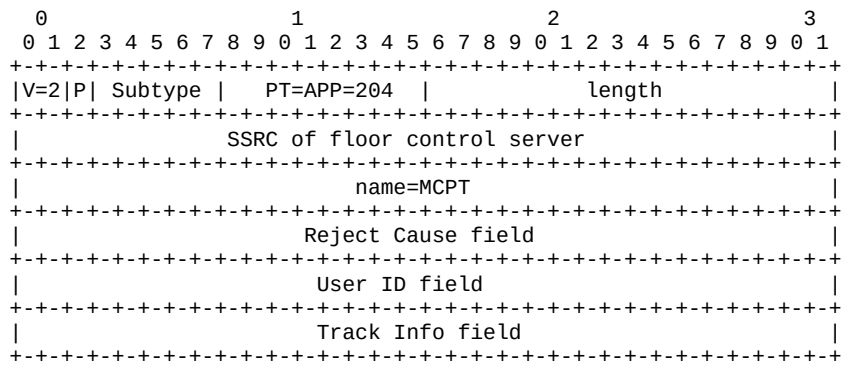
8.2.6 Floor Deny message

8.2.6.1 General

The Floor Deny message is sent as an action from the floor control server to the requesting floor participant to inform that the floor request was rejected. The Floor Deny message can only be used in the unicast transport mode.

Table 8.2.6.1-1 shows the content of the Floor Deny message.

Table 8.2.6.1-1: Floor Deny message



With the exception of the three first 32-bit words the order of the fields are irrelevant.

Subtype:

The subtype shall be coded according to table 8.2.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the floor control server.

The content of the SSRC field shall be coded as specified in IETF RFC 3550 [3].

Reject Cause:

The Reject Cause field includes the reason for the rejecting the floor request and can be followed by a text-string explaining why the floor request was rejected. Therefore the length of the packet will vary depending on the size of the application dependent field.

The Reject Cause field contains:

1. a <Reject Cause> value; and
2. a <Reject Phrase> value.

Available <Reject Cause> values are listed in subclause 8.2.6.2. The Reject Cause field is coded as described in subclause 8.2.3.4.

User ID:

The User ID field is used in off-network only. It shall carry the MCPTT ID of the floor participant sending Floor Deny message.

The User ID field shall be coded as specified in subclause 8.2.3.8.

Track Info:

The Track Info field shall be included when an MCPTT call involves a non-Controlling function. The coding of the Track Info field is described in subclause 8.2.3.13.

8.2.6.2 Rejection cause codes and rejection cause phrase

Cause #1 - Another MCPTT client has permission

The <Reject cause> value set to '1' indicates that another MCPTT user has permission to send a media.

Cause #2 - Internal floor control server error

The <Reject cause> value set to '2' indicates that the floor control server cannot grant the floor request due to an internal error.

Cause #3 - Only one participant

The <Reject cause> value set to '3' indicates that the floor control server cannot grant the floor request, because the requesting party is the only participant in the MCPTT session.

Cause #4 - Retry-after timer has not expired

The <Reject cause> value set to '4' indicates that the floor control server cannot grant the floor request, because timer T9 (Retry-after) has not expired after permission to send media has been revoked.

Cause #5 - Receive only

The <Reject cause> value set to '5' indicates that the floor control server cannot grant the floor request, because the requesting party only has receive privilege.

The value of the reason code field shall be: '5'.

Cause #6 - No resources available

The <Reject cause> value set to '6' indicates that the floor control server cannot grant the floor request due to congestion.

The value of the reason code field shall be: '6'.

Cause #7 – Queue full

The <Reject cause> value set to 7 indicates that the floor control server cannot queue the floor request, because the queue is full.

The value of the reason code field shall be: '7'.

Cause #255 - Other reason

The <Reject cause> value set to '255' indicates that the floor control server does not grant the floor request due to the floor control server local policy.

The value of the Reason code field shall be: '255'.

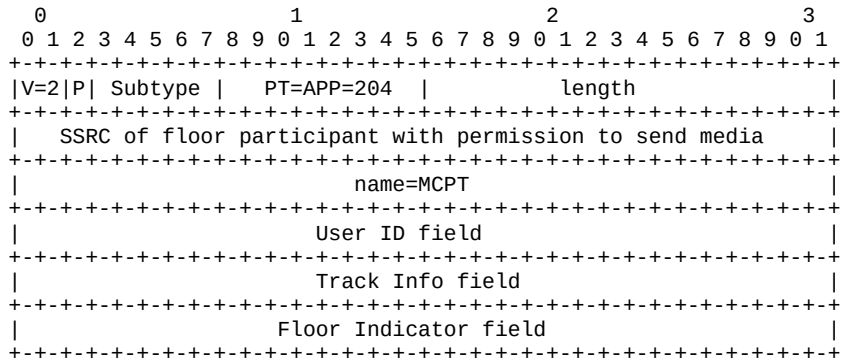
8.2.7 Floor Release message

The Floor Release message is sent as an action from the floor participant to the floor control server to inform that the floor can be released. The Floor Release message can only be used in the unicast transport mode.

The Floor Release message may also be sent if the floor participant has a request in the floor request queue. In this case, the Floor Release message is sent to cancel the floor request in the queue.

Table 8.2.7-1 shows the content of the Floor Release message.

Table 8.2.7-1: Floor Release message



With the exception of the three first 32-bit words the order of the fields are irrelevant.

Subtype:

The subtype shall be coded according to table 8.2.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the floor participant with permission to send media.

The content of the SSRC field shall be coded as specified in IETF RFC 3550 [3].

User ID:

The User ID field is used in off-network only. It shall carry the MCPTT ID of the floor participant sending the floor release message.

The User ID field shall be coded as specified in subclause 8.2.3.8.

Track Info:

The Track Info field shall be included when an MCPTT call involves a non-Controlling function. The coding of the Track Info field is described in subclause 8.2.3.13.

Floor Indicator:

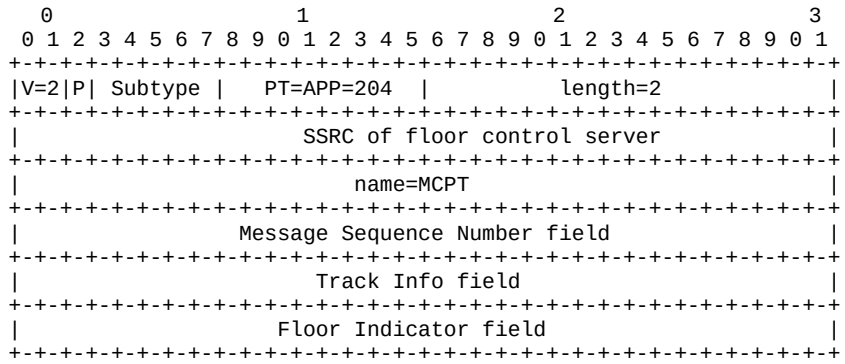
The Floor Indicator field shall be coded as described in subclause 8.2.3.15.

8.2.8 Floor Idle message

The Floor Idle message is sent as an action from the floor control server to the floor participant indicating that no floor participant has permission to send media. The Floor Idle message can be used in unicast and broadcast transport modes.

Table 8.2.8-1 shows the content of the Floor Idle message.

Table 8.2.8-1: Floor Idle message



With the exception of the three first 32-bit words the order of the fields are irrelevant.

Subtype:

The subtype shall be coded according to table 8.2.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the floor control server.

The content of the SSRC field shall be coded as specified in IETF RFC 3550 [3].

Message Sequence Number:

The Message Sequence Number field shall be coded as specified in to subclause 8.2.3.10.

Track Info:

The Track Info field shall be included when an MCPTT call involves a non-Controlling function. The coding of the Track Info field is described in subclause 8.2.3.13.

Floor Indicator:

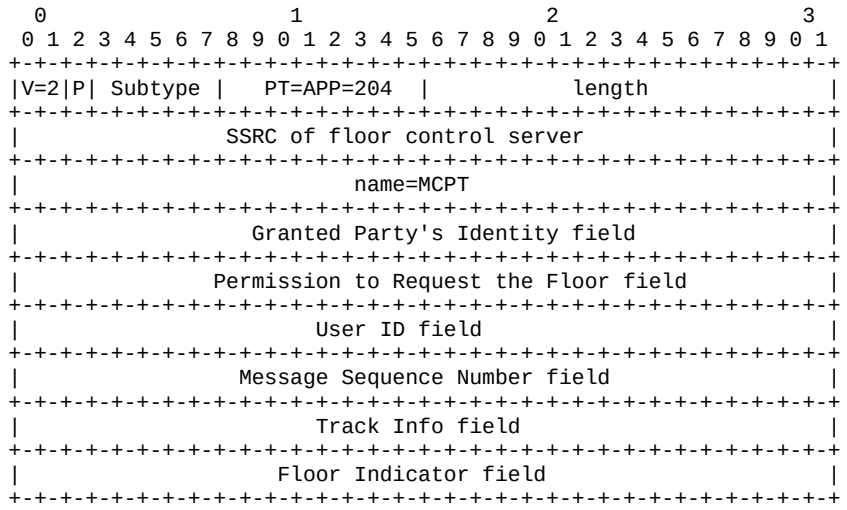
The Floor Indicator field shall be coded as described in subclause 8.2.3.15.

8.2.9 Floor Taken message

The Floor Taken message is sent as an action from the floor control server to inform non-requesting floor participant(s) that someone has been granted permission to send media. The Floor Taken message can be used in unicast and broadcast transport modes.

Table 8.2.9-1 shows the content of the Floor Taken message.

Table 8.2.9-1: Floor Taken message



With the exception of the three first 32-bit words the order of the fields are irrelevant.

Subtype:

The subtype shall be coded according to table 8.2.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the floor control server.

The content of the SSRC field shall be coded as specified in IETF RFC 3550 [3].

Granted Party"s Identity:

The Granted Party"s Identity field shall be coded as specified in subclause 8.2.3.6.

Permission to request the floor:

The Permission to Request the Floor field shall be coded as specified in subclause 8.2.3.7.

User ID:

The User ID field is used in off-network only. It shall carry the MCPTT user ID of the floor participant sending the Floor Taken message.

The User ID field shall be coded as specified in subclause 8.2.3.8.

Message Sequence Number:

The Message Sequence Number field shall be coded as specified in to subclause 8.2.3.10.

Track Info:

The Track Info field shall be included when an MCPTT call involves a non-Controlling function. The coding of the Track Info field is described in subclause 8.2.3.13.

Floor Indicator:

The Floor Indicator field shall be coded as described in subclause 8.2.3.15.

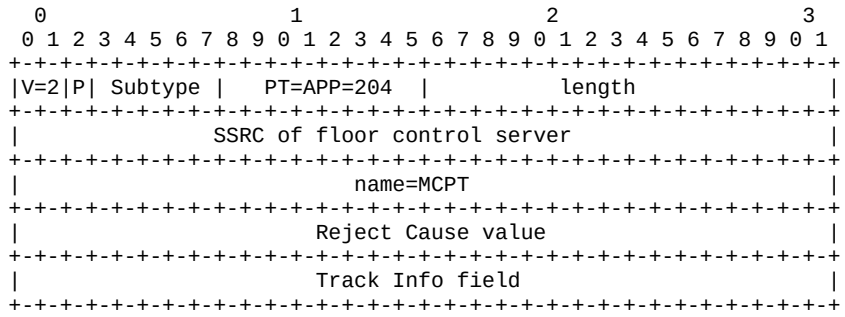
8.2.10 Floor Revoke message

8.2.10.1 General

The Floor Revoke message is sent from the floor control server to the floor participant with the permission to send media to inform that the permission to send media is revoked. The Floor Revoke message is used in the unicast transport mode towards the floor participant with the permission to send media in on-network mode.

Table 8.2.10.1-1 shows the content of the Floor Revoke message.

Table 8.2.10.1-1: Floor Revoke message



With the exception of the three first 32-bit words the order of the fields are irrelevant.

Subtype:

The subtype shall be coded according to table 8.2.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the floor control server.

The content of the SSRC field shall be coded as specified in IETF RFC 3550 [3].

Reject Cause:

The Reject Cause field for the Floor Revoke message shall include <Reject Cause> cause value in the Reject Cause field explaining why the floor control server wants the floor participant to stop sending media and may be followed by additional information. Therefore the length of the packet can vary depending on the value of the rejection cause.

The coding of the <Reject Cause> value is specified in subclause 8.2.3.4.

Track Info:

The Track Info field shall be included when an MCPTT call involves a non-Controlling function. The coding of the Track Info field is described in subclause 8.2.3.13.

8.2.10.2 Floor revoke cause codes and revoke cause phrases

Cause #1 – Only one MCPTT client

> The <Reject Cause> value set to '1' indicates that the MCPTT client is the only MCPTT client in the MCPTT session or the only participant connected to a floor control server. No additional information shall be included.

Cause#2 – Media burst too long

> The <Reject Cause> value set to '2' indicates that the MCPTT User has talked too long (e.g., the stop-talking timer has expired). No additional information shall be included.

Cause#3 - No permission to send a Media Burst

The <Reject Cause> value set to '3' indicates that the MCPTT client does not have permission to send media. No additional information shall be included.

Cause#4 - Media Burst pre-empted

The <Reject Cause> value set to '4' indicates that the MCPTT client 's permission to send a media is being pre-empted. No additional information shall be included.

Cause#6 - No resources available

The <Reject Cause> value set to '6' indicates that the floor control server can no longer grant MCPTT client to send media due to congestion. No additional information shall be included.

Cause#255 – Other reason

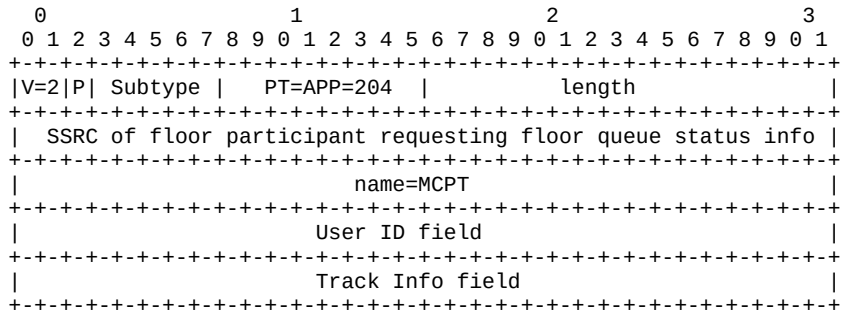
The <Reject Cause> value set to '255' indicates that the floor control server can no longer grant MCPTT client to send media due to the floor control server local policy. No additional information shall be included.

8.2.11 Floor Queue Position Request message

The Floor Queue Position Request message is a request from a floor participant to get information about the floor participant's position in the floor request queue. The Floor Queue Position Request message can be used in on-network over the unicast bearer and in off-network.

Table 8.2.11-1 shows the content of the Floor Queue Position Request message.

Table 8.2.11-1: Floor Queue Position Request message



With the exception of the three first 32-bit words the order of the fields are irrelevant.

Subtype:

The subtype shall be coded according to table 8.2.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the floor participant that is requesting information about its position in the floor request queue.

The SSRC field shall be coded as specified in IETF RFC 3550 [3].

User ID:

The User ID field is used in off-network only. It shall carry the MCPTT user ID of the floor participant sending the Floor Queue Position Request message.

The User ID field shall be coded as specified in subclause 8.2.3.8.

Track Info:

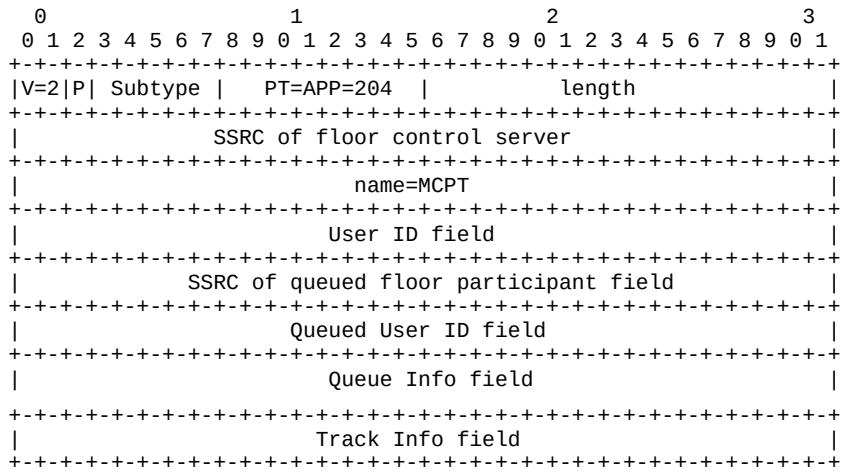
The Track Info field shall be included when an MCPTT call involves a non-Controlling function. The coding of the Track Info field is described in subclause 8.2.3.13.

8.2.12 Floor Queue Position Info message

The Floor Queue Position Info message is sent by the floor control server to notify the floor participant of its position in the floor request queue. The Floor Queue Position Info message is sent in response to a Floor Queue Position Request message if the request is queued. It can be sent at other times, e.g. if the floor participant is removed from the floor request queue or if the position or priority of the floor request is changed. The Floor Queue Position Info message can be used in on-network over the unicast bearer and in off-network.

Table 8.2.12-1 shows the content of the Floor Queue Position Info message.

Table 8.2.12-1: Floor Queue Position Info message



With the exception of the three first 32-bit words the order of the fields are irrelevant.

Subtype:

The subtype shall be coded according to table 8.2.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the floor control server.

The SSRC field shall be coded as specified in IETF RFC 3550 [3].

User ID:

The User ID field is used in off-network only. It shall carry the MCPTT ID of the floor participant sending the Floor Queue Position Info message.

The User ID value shall be coded as specified in subclause 8.2.3.8.

SSRC of queued floor participant:

The SSRC of queued floor participant is only applicable in off-network and shall carry the SSRC of the queued floor participant.

The SSRC field shall be coded as specified in IETF RFC 3550 [3].

Queued User ID:

The Queued User ID field is used in off-network only. It shall carry the MCPTT ID of the queued floor participant.

The Queued User ID value shall be coded as specified in subclause 8.2.3.8.

Queue Info:

The Queue Info field is only applicable in off-network and defines the queue position and granted floor priority in the queue.

The Queue Info field shall be coded as specified in subclause 8.2.3.5.

Track Info:

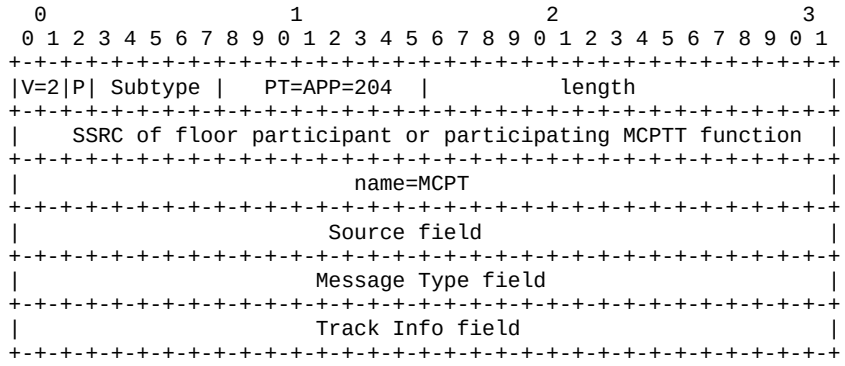
The Track Info field shall be included when an MCPTT call involves a non-Controlling function. The coding of the Track Info field is described in subclause 8.2.3.13.

8.2.13 Floor Ack message

The Floor Ack message is used to acknowledge any floor control message that included the 8 bit set to 1 (see subclause 8.2.2).

Table 8.2.13-1 shows the content of the Floor Ack message.

Table 8.2.13-1: Floor Ack message



Subtype:

The subtype shall be coded according to table 8.2.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the floor participant.

The SSRC field shall be coded as specified in IETF RFC 3550 [3].

Source:

The Queue Info field shall be coded as specified in subclause 8.2.3.5.

Message Type:

The Message Type field shall contain the floor control message that is acknowledged by the Floor Ack message. The Message Type field shall be coded as specified in subclause 8.2.3.14.

Track Info:

The Track Info field shall be included when an MCPTT call involves a non-Controlling function. The coding of the Track Info field is described in subclause 8.2.3.13.

8.3 Pre-established session call control

8.3.1 Introduction

The pre-established session call control messages shall be coded as described in subclause 8.1.2 where the pre-established session call control message is part of the application-dependent data.

For the pre-established session call control protocol the ASCII name string shall be: MCPC (Mission Critical Pre-established session call Control).

A list of pre-established session call control messages can be found in the subclause 8.3.2.

Pre-established session call control specific fields are specified in subclause 8.3.3.

8.3.2 Pre-established session call control message

The table 8.3.2-1 provides a list of floor control messages.

Table 8.3.2-1: Pre-established session call control specific messages

Message name	Subtype	Reference	Direction
Connect	x0000	Subclause 8.3.4	Server → client
Disconnect	x0001	Subclause 8.3.5	Server → client
Acknowledgement	00010	Subclause 8.3.6	Client → server
NOTE: The participating MCPTT function is the server and the floor participant is the client.			

For some messages the first bit (marked as x in the subtype) can be used to indicate if the sender wants to have an acknowledgment. The x is coded as follows:

0 Acknowledgment is not required

1 Acknowledgment is required

NOTE: Whether a message needs to be acknowledged or not is described in clause 9.

If an acknowledgment is required the Acknowledgement message is used to acknowledge the message.

8.3.3 Pre-established session call control fields

8.3.3.1 Introduction

This subclause describe fields specific for the pre-established session call control.

The pre-established session call control protocol specific fields are contained in the application-dependent data of the pre-established session call control message.

Each pre-established session call control protocol specific field consists of an 8-bit field ID, an 8-bit octet length value describing the length of the field value not including the field ID or length value. Table 8.3.3.1-1 shows the pre-established session call control specific field structure.

Table 8.3.3.1-1: Pre-established session call control protocol specific field structure

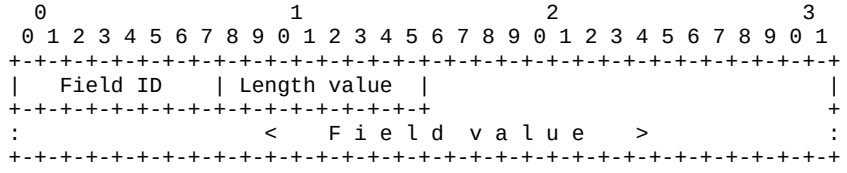


Table 8.3.3.1-2 lists the available fields including the assigned field ID.

Table 8.3.3.1-2: Pre-established session call control fields

Field name	Field ID		Reference
	Decimal	Binary	
-	000-099		IETF RFC 3550 [3] (NOTE)
Media Streams	000	00000000	Subclause 8.3.3.2
MCPTT Session Identity	001	00000001	Subclause 8.3.3.3
Warning Text	002	00000010	Subclause 8.3.3.4
MCPTT Group Identity	003	00000011	Subclause 8.3.3.5
Answer State	004	00000100	Subclause 8.3.3.6
Inviting MCPTT User Identity	005	00000101	Subclause 8.3.3.7
Reason Code	006	00000110	
NOTE: The value range 000 – 099 is used by RTCP.			

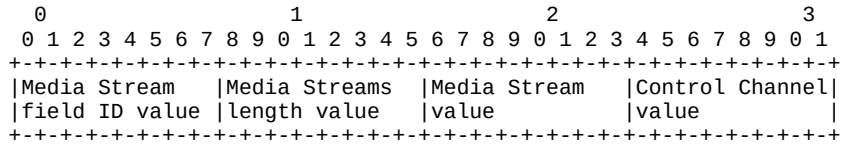
The following subclauses describe the coding of each field.

8.3.3.2 Media Streams field

The Media Streams field describes which media streams to use in the session. At the minimum one <Media Stream> value shall be included. The <Control Channel> value item is only needed when floor control applies during the MCPTT call.

Table 8.3.3.2-1 describes the coding of the Media Streams field.

Table 8.3.3.2-1: Media Streams field coding



The <Media Streams field ID> value is a binary value and shall be set according to table 8.3.3.1-2.

The <Media Streams length> value shall is a binary value indicating the length in octets of the <Media Stream> value and <Control channel> value items.

The <Media Stream> value shall consist of 8 bit parameter giving the number of the" m=audio" m-line negotiated in the pre-established session.

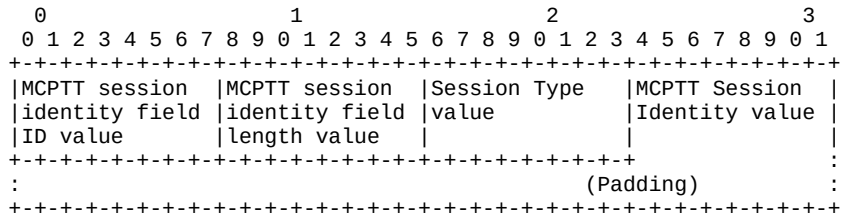
The <Control Channel> value shall consist of 8 bit parameter giving the number of the "m=application" m-line negotiated in the pre-established session. The <Control Channel> value is set to "0" when no floor control is used during the session.

8.3.3.3 MCPTT Session Identity field

The MCPTT Session Identity field contains the MCPTT session identity and the session type.

Table 8.3.3.3-1 describes the coding of the MCPTT Session Identity field.

Table 8.3.3.3-1: MCPTT Session Identity field coding



The <MCPTT Session Identity field ID> value is a binary value and shall be set according to table 8.3.3.1-2.

The <MCPTT Session Identity length> value shall is a binary value indicating the length in octets of the <Session Type> value and <MCPTT Session Identity> value items.

The <Session Type> value is coded as follows:

- 00000000 = no session type
- 00000001 = private
- 00000011 = prearranged
- 00000100 = chat

All other values are reserved for future use.

<MCPTT Session Identity> value contains a SIP URI, which identifies the MCPTT session between the MCPTT client and the controlling MCPTT function; see 3GPP TS 24.379 [2] subclause 4.5. The <MCPTT Session Identity> value is coded specified in table 8.3.3.3-2.

Table 8.3.3.3-2: ABNF syntax of string values of the <MCPTT Session Identity> value

```
mcptt-session-identity = SIP-URI
```

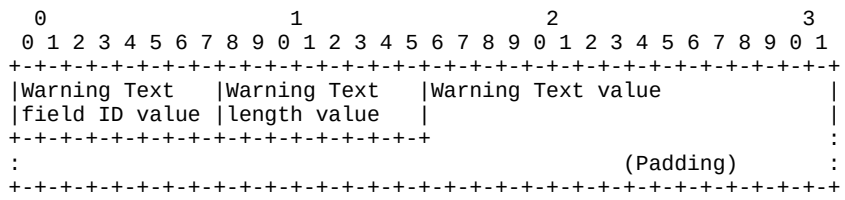
If the length of the <MCPTT Session Identity> value is not a multiple of 4 bytes, the MCPTT Session Identity field shall be padded to a multiple of 4 bytes. The value of the padding bytes should be set to zero. The padding bytes shall be ignored.

8.3.3.4 Warning Text field

The Warning Text field contains the text string returned by the controlling MCPTT function in responses to a SIP INVITE request as described in 3GPP TS 24.379 [2] subclause 4.4.

Table 8.3.3.4-1 describes the coding of the Warning Text field.

Table 8.3.3.4-1: Warning Text field coding



The <Warning Text field ID> value is a binary value and shall be set according to table 8.3.3.1-2.

The <Warning Text length> value is a binary value indicating the length in octets of the <Warning Text> value item excluding any padding octets.

The <Warning Text> value shall be coded as specified in 3GPP TS 24.379 [2] table 4.4.2-1.

EXAMPLE: If the Warning: 399 "100 User not authorised to make group calls" is received, the 399 "100 User not authorised to make group calls" is included as the <Warning Text> value.

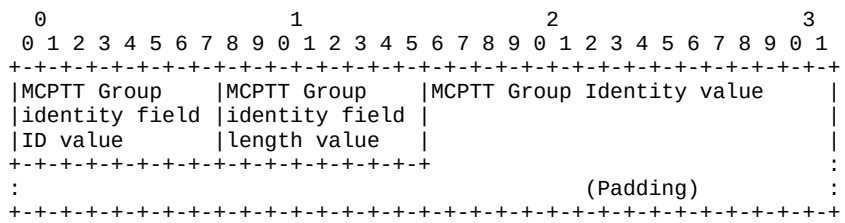
If the length of the <Warning Text> value is not a multiple of 4 bytes, the Warning Text field shall be padded to a multiple of 4 bytes. The value of the padding bytes should be set to zero. The padding bytes shall be ignored.

8.3.3.5 MCPTT Group Identity field

The MCPTT Group Identity field contains a SIP URI identifying the group that an MCPTT client is invited to.

Table 8.3.3.5-1 describes the coding of the MCPTT Group Identity field.

Table 8.3.3.5-1: MCPTT Group Identity field coding



The <MCPTT Group Identity field ID> value is a binary value and shall be set according to table 8.3.3.1-2.

The <MCPTT Group Identity length> value shall is a binary value indicating the length in octets of the <MCPTT Group Identity> value item.

<MCPTT Group Identity> value contains a SIP URI, which identifies the MCPTT group. The <MCPTT Group Identity> value shall be coded as specified in the table 8.3.3.3-2.

Table 8.3.3.3-2: ABNF syntax of string values of the <MCPTT Group Identity> value

```
mcptt-group-identity = SIP-URI
```

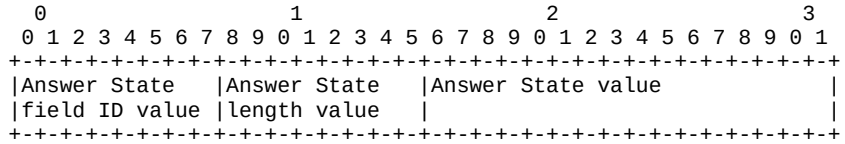
If the length of the <MCPTT Group Identity> value is not a multiple of 4 bytes, the MCPTT Group Identity field shall be padded to a multiple of 4 bytes. The value of the padding bytes should be set to zero. The padding bytes shall be ignored.

8.3.3.6 Answer State field

The Answer State field indicates if invited MCPTT users are invited using automatic or manual commencement mode.

Table 8.3.3.6-1 describes the coding of the Answer State field.

Table 8.3.3.6-1: Answer State field coding



The <Answer State field ID> value is a binary value and shall be set according to table 8.3.3.1-2.

The <Answer State length> value is a binary value and shall have the value '2' indicating the total length in octets of the <Answer State> value item.

The <Answer State> value is a 16-bit binary value with the following values:

0 Unconfirmed

1 Confirmed

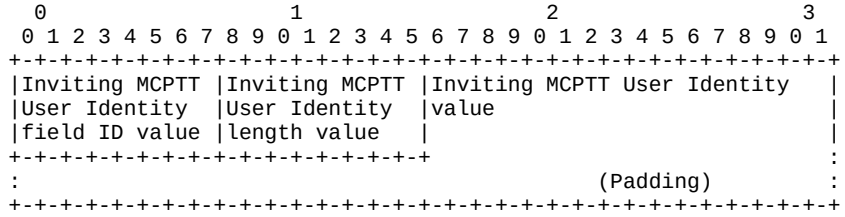
All other values are reserved for future use.

8.3.3.7 Inviting MCPTT User Identity field

The Inviting MCPTT User Identity field contains the MCPTT ID identifying the inviting MCPTT user.

Table 8.3.3.7-1 describes the coding of the Inviting MCPTT User Identity field.

Table 8.3.3.7-1: Inviting MCPTT User Identity field coding



The <Inviting MCPTT User Identity field ID> value is a binary value and shall be set according to table 8.3.3.1-2.

The <Inviting MCPTT User Identity length> value shall is a binary value indicating the length in octets of the <MCPTT Group Identity> value item.

The <Inviting MCPTT User Identity> value contains a SIP URI, which identifies the inviting MCPTT user. The <Inviting MCPTT User Identity> value shall be coded as specified in the table 8.3.3.7-2.

Table 8.3.3.7-2: ABNF syntax of string values of the <Inviting MCPTT User Identity> value

```
inviting-mcptt-user-identity = SIP-URI
```

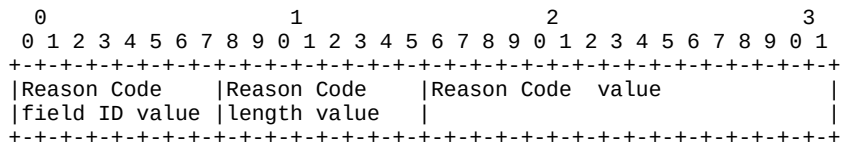
If the length of the <MCPTT Group Identity> value is not a multiple of 4 bytes, the Inviting MCPTT User Identity field shall be padded to a multiple of 4 bytes. The value of the padding bytes should be set to zero. The padding bytes shall be ignored.

8.3.3.8 Reason Code field

The Reason Code field contains the answer to a pre-established call control message.

Table 8.3.3.8-1 describes the coding of the Reason Code field.

Table 8.3.3.8-1: Reason Code field coding



The <Reason Code field ID> value is a binary value and shall be set according to table 8.3.3.1-2.

The <Reason Code length> value is a binary value and shall have the value '2' indicating the total length in octets of the <Reason Code> value item.

The <Reason Code> value is a 16-bit binary value with the following values:

0 Accepted

1 Busy

2 Not Accepted

All other values are reserved for future use.

8.3.3.9 Handling of unknown fields and messages

When a pre-establish session control message is received the MCPTT client and the participating MCPT function shall:

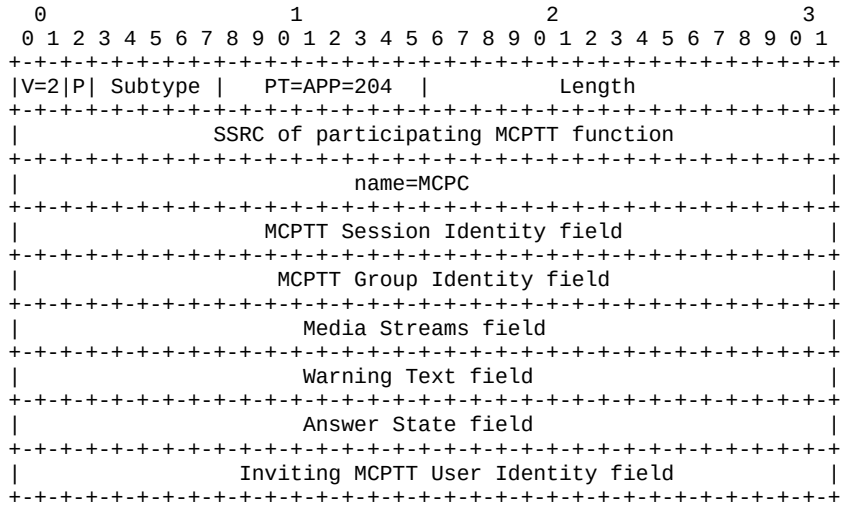
1. ignore the whole message, if the subtype is unknown;
2. ignore the unspecified fields in the message (e.g. specified in future version of the pre-establish session control protocol); and
3. ignore the syntactically incorrect optional fields.

8.3.4 Connect message

The Connect message is sent by the participating MCPTT function on the originating side to the MCPTT client to confirm the establishment of an MCPTT call or sent on the terminating side to initiate an MCPTT call. The Connect message is only used in the on-network mode and only sent over the unicast bearer.

Table 8.3.4-1 shows the content of the Connect message.

Table 8.3.4-1: Connect message



With the exception of the three first 32-bit words the order of the fields are irrelevant.

Subtype:

The subtype shall be coded according to table 8.3.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the participating MCPTT function.

The SSRC field shall be coded as specified in IETF RFC 3550 [3].

MCPTT Session Identity:

The MCPTT Session Identity field is coded as described in subclause 8.3.3.3.

MCPTT Group Identity:

The MCPTT Group Identity field is coded as described in subclause 8.3.3.5.

Media Streams:

The Media Streams field is coded as described in subclause 8.3.3.2.

Warning Text:

The Warning Text field is coded as described in subclause 8.3.3.4.

Answer State:

The Answer State field is coded as described in subclause 8.3.3.6.

When the Answer State field is not included the value "confirmed" shall be assumed.

Inviting MCPTT User Identity:

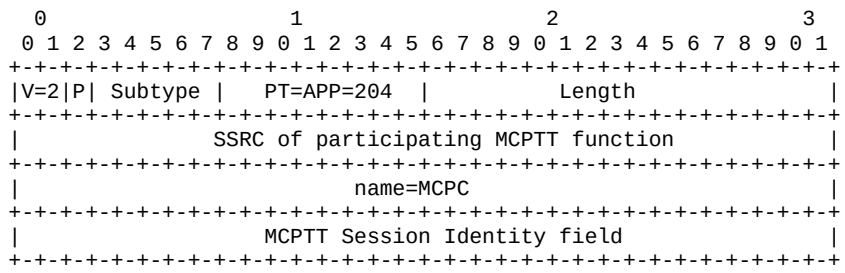
The Inviting MCPTT User Identity field is coded as described in subclause 8.3.3.5.

When the inviting MCPTT user requested privacy, the <sip:anonymous@invalid.invalid> identity shall be used.

8.3.5 Disconnect message

Table 8.3.5-1 shows the content of the Connect message.

Table 8.3.5-1: Disconnect message



With the exception of the three first 32-bit words the order of the fields are irrelevant.

Subtype:

The subtype shall be coded according to table 8.3.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the participating MCPTT function.

The SSRC field shall be coded as specified in IETF RFC 3550 [3].

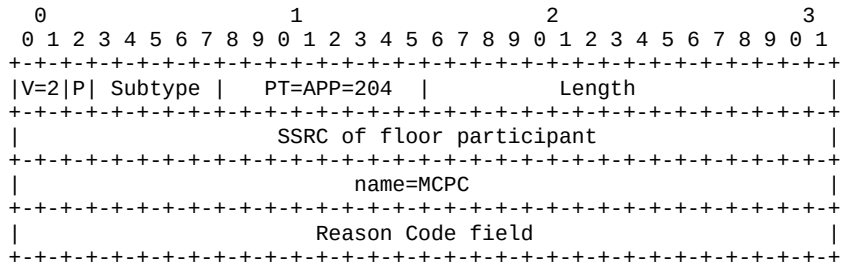
MCPTT Session Identity:

The MCPTT Session Identity field is coded as described in subclause 8.3.3.3.

8.3.6 Acknowledgement message

Table 8.3.6-1 shows the content of the Acknowledgement message.

Table 8.3.6-1: Acknowledgement message



With the exception of the three first 32-bit words the order of the fields are irrelevant.

Subtype:

The subtype shall be coded according to table 8.3.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the floor participant.

The SSRC field shall be coded as specified in IETF RFC 3550 [3].

Reason Code:

The Reason Code field is coded as described in subclause 8.3.3.8.

8.4 MBMS subchannel control

8.4.1 Introduction

The MBMS subchannel control messages shall be coded as described in subclause 8.1.2 where the MBMS subchannel control message is part of the application-dependent data.

For the MBMS subchannel control protocol the ASCII name string shall be: MCCP.

The list of MBMS subchannel control messages can be found in the subclause 8.4.2.

The MBMS subchannel control specific fields are specified in subclause 8.4.3.

8.4.2 MBMS subchannel control messages

Table 8.4.2-1 provides a list of MBMS subchannel control protocol messages.

Table 8.4.2-1: MBMS subchannel control protocol messages

Message name	Subtype	Reference	Direction
Map Group To Bearer	00000	subclause 8.4.4	Server → client
Unmap Group To Bearer	00001	subclause 8.4.5	Server → client
NOTE: The participating MCPTT function is the server and the MCPTT client is the client.			

8.4.3 MBMS subchannel control specific fields

8.4.3.1 Introduction

This subclause describe fields specific for the MBMS subchannel control.

The MBMS subchannel control specific fields are contained in the application-dependent data of the MBMS subchannel control message.

Each MBMS subchannel control specific field consists of an 8-bit <Field ID> item, an 8-bit octet <Length> value item containing the length of the field value not including <Field ID> or the <Length> value items. Table 8.4.3.1-1 shows the MBMS subchannel control specific field structure.

Table 8.4.3.1-1: MBMS subchannel control protocol specific field structure

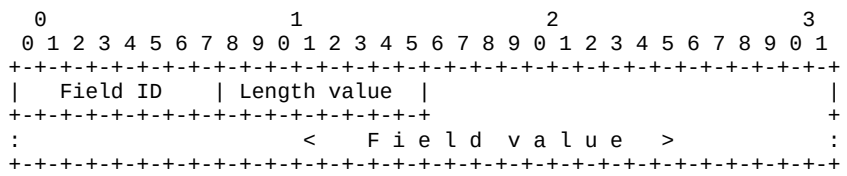


Table 8.4.3.1-2 lists the available fields including the assigned Field ID.

Table 8.4.3.1-2: MBMS subchannel control protocol specific fields

Field name	Field ID	Reference	Description
-	000-099	IETF RFC 3550 [3]	Used by RTCP
Subchannel	000	00000000	Subclause 8.4.3.3
TMGI	001	00000001	Subclause 8.4.3.4.
MCPTT Group ID	003	00000011	Subclause 8.4.3.2

8.4.3.5 Handling of unknown fields and messages

When a MBMS subchannel control message is received the floor participant and the participating MCPTT function shall:

1. ignore the whole message, if the subtype is unknown;
2. ignore the unspecified fields in the message (e.g. specified in future version of the MBMS subchannel control protocol); and
3. ignore the syntactically incorrect optional fields.

8.4.3.2 MCPTT Group ID field

The MCPTT Group ID field contains a SIP URI identifying the MCPTT group for which media and floor control messages are going to be broadcasted over a MBMS subchannel.

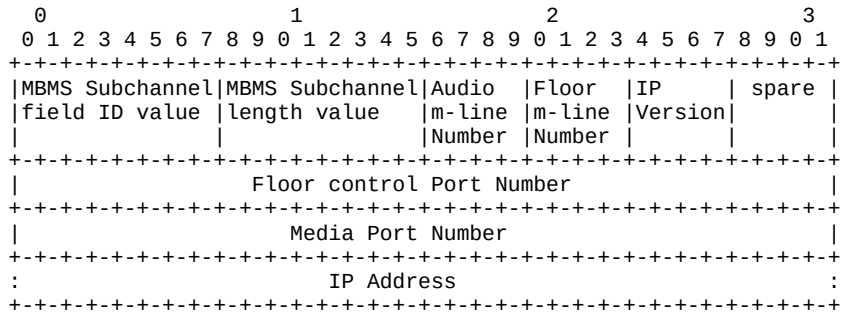
The MCPTT Group ID field is coded as the MCPTT Group Identity field specified in subclause 8.3.3.5.

8.4.3.3 MBMS Subchannel field

The MBMS Subchannel field describes which MBMS subchannel to use for media and for floor control.

Table 8.4.3.2-1 describes the coding of the MBMS Subchannel field.

Table 8.3.3.2-1: MBMS Subchannel field coding



The <MBMS Subchannel field ID> value is a binary value and shall be set according to table 8.3.3.1-2.

The <MBMS Subchannel length> value shall is a binary value indicating the total length in octets of the <Audio m-line Number> value, <IP Version> value, spare, <Port Number> value and <IP address> items.

The <Audio m-line Number> value shall consist of 8 bit parameter giving the number of the" m=audio" m-line in the SIP MESSAGE request announcing the MBMS bearer described in 3GPP TS 24.379 [2].

The <Floor m-line Number> value shall consist of 8 bit parameter giving the number of the "m=application" m-line in the SIP MESSAGE request announcing the MBMS bearer described in 3GPP TS 24.379 [2]. The <MBMS Floor Control Subchannel> value is set to "0" when the same subchannel is used for media and for floor control.

The <IP version> value indicates the IP version:

0 IP version 4

1 IP version 6

All other values are reserved for future use.

The "spare" octet shall be set to "0000".

The <Floor Port Number> value is a 32-bit binary value giving the port to be used if the<Floor m-line Number> value is greater than '0'. If the <Floor m-line Number> value is equal to '0', the <Floor Port Number> value is not included in the MBMS Subchannel field.

The <Media Port Number> value is a 32-bit binary value giving the port to be used. The <Media Port Number> value is always present in the MBMS Subchannel field.

The <IP Address> value is:

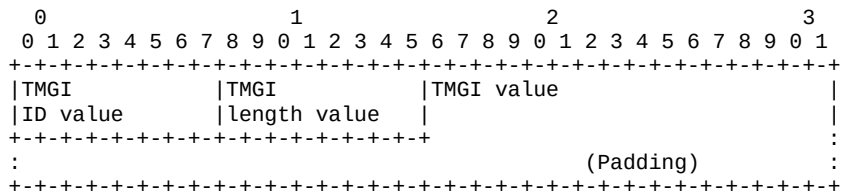
1. a 32 bit binary value containing the IP v4 address if the <IP version> indicates that the <IP Address> value is a IP v4 Address; or

4 four 32-bit words that together forms a 128 bit binary value representing the IP v6 address, if the <IP version> indicates that the <IP Address> value is a IP v6 Address

8.4.3.4 TMGI field

Table 8.4.3.2-1 describes the coding of the TMGI field.

Table 8.4.3.4-1: TMGI field coding



The <TMGI field ID> value is a binary value and shall be set according to table 8.4.3.1-2.

The <TMGI length> value shall is a binary value indicating the length in octets of the <TMGI> value item.

The <TMGI> value is coded as described in 3GPP TS 24.008 [11] subclause 10.5.6.13 excluding the Temporary Mobile Group Identity IEI and Length of Temporary Mobile Group Identity contents (octet 1 and octet 2 in 3GPP TS 24.008 [11] subclause 10.5.6.13).

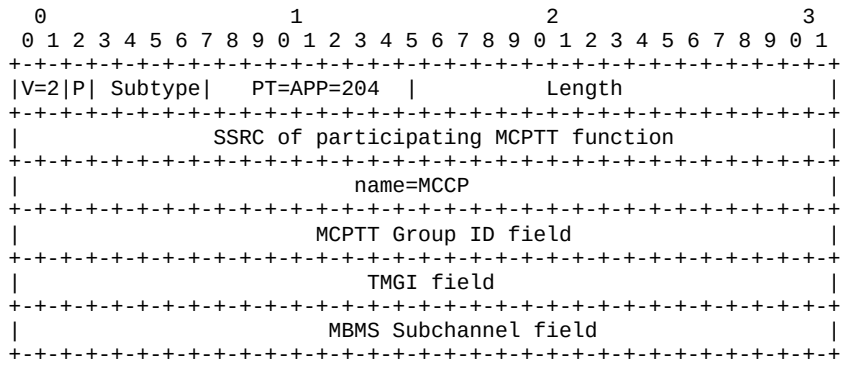
If the length of the <TMGI> value is not a multiple of 4 bytes, the TMGI field shall be padded to a multiple of 4 bytes. The value of the padding bytes should be set to zero. The padding bytes shall be ignored.

8.4.4 Map Group To Bearer message

The Map Group To Bearer message is sent by the participating function when a conversation is started.

Table 8.4.4-1 shows the content of the Map Group To Bearer message.

Table 8.4.4-1: Map Group To Bearer message



With the exception of the three first 32-bit words the order of the fields are irrelevant.

Subtype:

The subtype shall be coded according to table 8.4.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the participating MCPTT function.

The SSRC field shall be coded as specified in IETF RFC 3550 [3].

MCPTT Group ID:

The MCPTT Group ID field is coded as described in subclause 8.4.3.2.

TMGI:

The TMGI field is coded as described in subclause 8.4.3.4.

MBMS Subchannel:

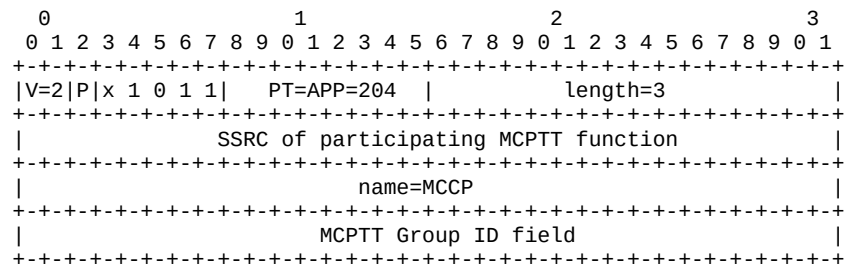
The MBMS Subchannel field is coded as described in subclause 8.4.3.3.

8.4.5 Unmap Group To Bearer message

The Unmap Group To Bearer message is sent by the participating function when a conversation is ended.

Table 8.4.5-1 shows the content of the Unmap Group To Bearer message.

Table 8.4.5-1: Unmap Group To Bearer message



With the exception of the three first 32-bit words the order of the fields are irrelevant.

Subtype:

The subtype shall be coded according to table 8.4.2-1.

Length:

The length shall be coded as specified in to subclause 8.1.2.

SSRC:

The SSRC field shall carry the SSRC of the participating MCPTT function.

The SSRC field shall be coded as specified in IETF RFC 3550 [3].

MCPTT Group ID:

The MCPTT Group ID field is coded as described in subclause 8.4.3.2.

9 Call setup control over pre-established session

9.1 General

The procedures described in this clause are applicable only after a pre-established session is established between the participating MCPTT function and the MCPTT client.

Once the use of an existing pre-established session is decided for a pre-arranged group call or for a chat group call or for a private call, as specified in 3GPP TS 24.379 [2], the participating MCPTT function shall inform the MCPTT client that this pre-established session is to be used as described in subclause 9.3 and the MCPTT client shall respond as described in subclause 9.2.

When a pre-arranged group call or a chat group call or a private call which uses a pre-established session is released as specified in 3GPP TS 24.379 [2], the participating MCPTT function shall inform the MCPTT client that the use of this pre-established session has ended as described in subclause 9.3 and the MCPTT client shall respond as described in subclause 9.2.

Media and media plane control procedures between a participating MCPTT function and MCPTT client for a pre-arranged group call or for a chat group call or for a private call and setup over a pre-established session are not affected by the use of the pre-established session.

Media plane security procedures for pre-established call control messages are specified in clause 13.

9.2 MCPTT client

9.2.1 General

If the MCPTT client supports pre-established session, the MCPTT client shall also support the behaviour implied by the state machine specified in this subclause. The specifications are on the reception or sending of media plane control messages related to the call setup control over pre-established session

An MCPTT client may have several pre-established session at a time.

9.2.2 Call setup control over pre-established session state machine

9.2.2.1 General

A call setup control over pre-established state machine has two states: Pre-established Session_Not_in_use and Pre-established Session_In_use. In addition the Sart-Stop state is specified for the initiation or the termination of the state machine. The state transitions are partly controlled by the call control procedures specified in 3GPP TS 24.379 [2].

Figure 9.2.2.1-1 shows the call setup control over pre-establised session state machine and the state transitions.

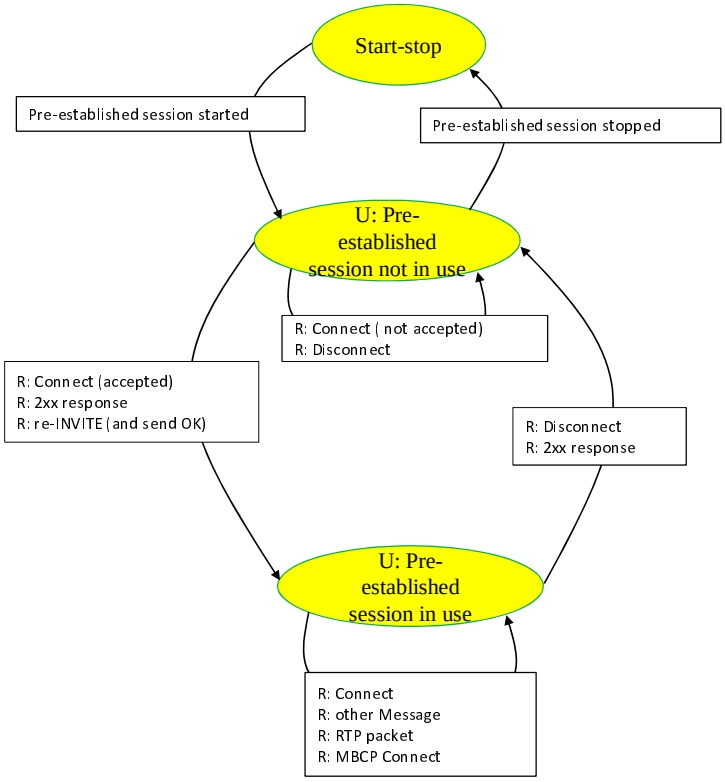


Figure 9.2.2.1-1: Call setup control over pre-establised session state machine.

The MCPTT client shall create one instance of the call setup control over pre-established state machine per pre-established session.

If a pre-established session call control message, a SIP request or RTP media packet arrives in any state and there is no procedure specified in the subclauses below, the MCPTT client shall discard the pre-established session call control message, SIP request or RTP media packet and shall remain in the current state.

9.2.2.2 State: 'Start-stop'

9.2.2.2.1 General

In this state no pre-established session exists

9.2.2.2.2 Pre-established session started

When a pre-established session is created between the MCPTT client and the participating MCPTT function, as specified in 3GPP TS 24.379 [2], the MCPTT client:

1. shall initialize any needed user plane resources for the pre-established session as specified in 3GPP TS 24.379 [2]; and
2. shall enter the 'U: Pre-established session not in use' state.

9.2.2.3 State: 'U: Pre-established session not in use'

9.2.2.3.1 General

The 'U: Pre-established session not in use' state is a stable state. The MCPTT client is in this state when a pre-established session is established, but it is not used for a call.

In this state the MCPTT client can receive call initiation message and floor control messages.

9.2.2.3.2 Receive Connect message (R: Connect)

Upon reception of a Connect message:

1. if the MCPTT client accepts the incoming call the MCPTT client:
   a. if the first bit in the subtype of the Connect message is set to '1' (acknowledgement is required), shall send the Acknowledgement message with Reason Code field set to 'Accepted';
   b. shall use only the media streams of the pre-established session which are indicated as used in the associated call session Media Streams field, if the Connect contains a Media Streams field;
   c. shall create an instance of the 'Floor participant state transition diagram for basic operation' as specified in subclause 6.2.4; and
   d. shall enter the 'U: Pre-established session in use' state; or
2. Otherwise the MCPTT client:
   a. if the first bit in the subtype of the Connect message is set to '1' (acknowledgement is required), shall send the Acknowledgement message with the Reason Code field set to 'Busy' or 'Not Accepted'; and
   b. shall remain in 'U: Pre-established session not in use' state.

9.2.2.3.3 Pre-established session stopped

When the associated pre-established session between the MCPTT client and the MCPTT server is released the MCPTT client:

1. shall release any user plane resources including any running timers associated with the pre-established session; and
2. shall enter the 'Start-stop' state and then the 'Call setup control over pre-establised session state machine' is released.

9.2.2.3.4 Receive Disconnect message (R: Disconnect)

Upon reception of a Disconnect message the MCPTT client:

1. if the first bit in the subtype of the Disconnect message is set to '1' (acknowledgement is required), shall send the Acknowledgement message with the Reason Code set to 'Accepted'; and

2. shall remain in 'U: Pre-established session not in use' state.

9.2.2.3.5 Receive SIP 2xx response (R:2xx response)

Upon reception of a SIP 2xx response for the SIP REFER request sent to initiate an MCPTT call session over a pre-established session as specified in 3GPP TS 24.379 [2], (to initiates a pre-arranged group call or private call or to join a chat group call) the MCPTT client shall enter the 'U: Pre-established session in use' state.

9.2.2.3.6 Receive SIP re-INVITE request (R: re-INVITE)

Upon sending the SIP 200 (OK) response to the SIP re-INVITE request for the use of the Pre-established session initiating an MCPTT call session as specified in 3GPP TS 24.379 [2] the MCPTT client shall enter the 'U: Pre-established session in use' state.

9.2.2.4 State: 'U: Pre-established session in use'

9.2.2.4.1 General

The MCPTT client is in this state when a pre-established session is established and it is used for an MCPTT call session.

In this state the MCPTT client can receive call release indication, floor control messages and RTP media packets.

9.2.2.4.2 Receive Connect message (R: Connect)

Upon reception of a Connect message the MCPTT client:

1. if the first bit in the subtype of the Connect message is set to '1' (acknowledgement is required), shall send Acknowledgement message with the Reason Code field set to 'Accepted'; and

2. shall remain in the 'U: Pre-established session in use' state.

Upon reception of a floor control message (i.e. messages other than the Connect message and the Disconnect message) the MCPTT client:

1. shall act as specified in subclause 6.2.4; and

2. shall remain in the 'U: Pre-established session in use' state.

9.2.2.4.4 Receive RTP media packets (R:RTP packet)

Upon reception of an RTP media packet the MCPTT client:

1. shall act as specified in subclause 6.2.4; and

2. shall remain in the 'U: Pre-established session in use' state.

9.2.2.4.5 Receive Disconnect message (R: Disconnect)

Upon reception of Disconnect message the MCPTT client:

1. if the first bit in the subtype of the Disconnect message is set to '1' (acknowledgement is required), shall send Acknowledgement message with the Reason Code field set to 'Accepted';

2. shall enter the 'U: Pre-established session not in use' state; and

3. shall act as specified in subclause 6.2.4.

9.2.2.4.6 Receive SIP 2xx response (R: 2xx response)

Upon receiving a 2xx response to the sent SIP REFER request as described in 3GPP TS 24.379 [2] when the call is released, but the Pre-established Session is kept alive the MCPTT client:

1. shall enter the 'U: Pre-established session not in use' state; and
2. shall terminate the instance of 'Floor participant state transition diagram for basic operation' state machine as specified in subclause 6.2.4.

9.3 Participating MCPTT function

9.3.1 General

The participating MCPTT function shall support the behaviour implied by the state machine specified in this subclause. The specifications are on the sending and reception of media plane control messages related to the call setup control over pre-established session

A participating MCPTT function may have several pre-established session at a time for multiple MCPTT clients and multiple pre-established sessions per MCPTT client.

9.3.2 Call setup control over pre-established session state machine for the participating MCPTT function

9.3.2.1 General

If the participating MCPTT function supports pre-established session, the participating MCPTT function shall behave according to the 'pre-established session state machine' and state transitions specified in this subclause.

The 'pre-established session state machine' has three states: 'G: Pre-established session not in use' state, 'G: Pre-established session in use' state and 'G: Call releasing' state, the state transitions are partially controlled by the specifications in 3GPP TS 24.379 [2]. The 'Start-stop' state is the initial and final state.

Figure 9.3.2.1-1 shows the state diagram and the state transitions of the 'pre-established session state machine'.

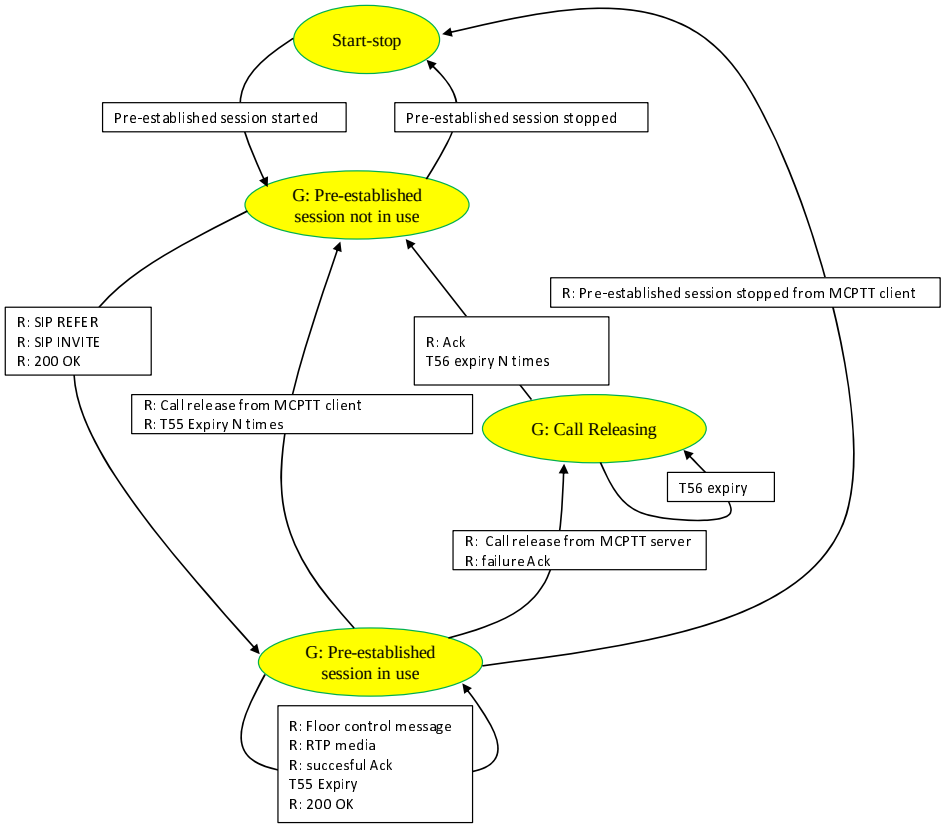


Figure 9.3.2.1-1: State transitions of Pre-established Session state machine

The participating MCPTT function shall create one instance of the 'pre-established session state machine' per pre-established session per MCPTT client.

State and state transition details are explained in the following subclauses.

If a pre-established session call control message, SIP request, SIP response or RTP media packet arrives in any state and there is no procedure specified for it in this subclauses below, the participating MCPTT function shall discard the pre-established session call control message, SIP request, SIP response or RTP media packet and remain in the current state.

9.3.2.2 State: 'Start-stop'

9.3.2.2.1 General

In this state no pre-established session exists.

9.3.2.2.2 Pre-established session started

When a pre-established session is created between the participating MCPTT function and an MCPTT client, the participating MCPTT function:

1. shall initiate any needed user plane resources for the pre-established session; and
2. shall enter the 'G: Pre-established session not in use' state.

9.3.2.3 State: 'G: Pre-established session not in use'

9.3.2.3.1 General

The 'G: Pre-established session not in use' state is a stable state. The participating MCPTT function is in this state when the pre-established session is established but it is not used for an MCPTT call.

In this state the participating MCPTT function can receive call initiation indication.

9.3.2.3.2 Receive SIP REFER request (R: SIP REFER)

Upon receiving a SIP REFER request from the MCPTT client the participating MCPTT function:

1. shall reserve user plane resources for the call session, if not yet reserved; and,
2. shall enter the 'G: Pre-established session in use' state.

9.3.2.3.3 Receive SIP INVITE request (R: SIP INVITE)

Upon receiving a SIP INVITE request from the controlling MCPTT function, if in automatic answer mode, the participating MCPTT function:

1. shall send the Connect message to the invited MCPTT client using the media plane control transport channel defined for this call. The Connect message:
   a. shall include the SIP URI received in the Contact header field of the SIP INVITE request in the <MCPTT Session Identity> value in the MCPTT Session Identity field;
   b. if the SIP INVITE request included an "application/vnd.3gpp.mcptt-info+xml" MIME body with the <session-type> element set to a value of "prearranged" or "chat":
      i. shall include the received P-Asserted-Identity header field in the MCPTT Group Identity field; and
      ii. shall include the value 'prearranged' or 'chat' in the <Session Type> value in the MCPTT Session Identity field;
   c. if the SIP INVITE request includes an "application/vnd.3gpp.mcptt-info+xml" MIME body with the <session-type> element set to a value of "private":
      i. shall include the MCPTT ID of the inviting MCPTT user in the Inviting MCPTT User Identity field if available from the SIP INVITE message and privacy of the inviting MCPTT ID is not required;
      ii. shall include 'anonymous@anonymous.invalid' in the Inviting MCPTT User Identity field if the MCPTT ID of the inviting MCPTT user is not available from the SIP INVITE message or privacy of the inviting MCPTT ID is required; and
      iii. shall include the value 'private' in the <Session Type> value in the MCPTT Session Identity field;
   d. if the SIP INVITE request does not include an "application/vnd.3gpp.mcptt-info+xml" MIME body with the <session-type> element:
      i. shall include the MCPTT ID of the inviting MCPTT user in the Inviting MCPTT User Identity field if available from the SIP INVITE message and privacy of the inviting MCPTT ID is not required;
      ii. shall include 'anonymous@anonymous.invalid' in the Inviting MCPTT User Identity field if the MCPTT ID of the inviting MCPTT user is not available from the SIP INVITE message or privacy of the inviting MCPTT ID is required; and
      iii. shall include the value 'no session type' in the <Session Type> value in the MCPTT Session Identity field;
   e. shall include a Media Streams field, if the negotiated SDP in the pre-arranged session contains more media streams than required by the SDP in the SIP INVITE request; and

   NOTE 1: For example if the call is a private call without floor control the Media Streams field needs to be included with the <Control Channel> value set to '0'.

   f. should set the first bit in the subtype of the Connect message to '1' (Acknowledgment is required) as described in subclause 8.3.2;
2. shall start timer T55 (Connect);
3. shall initialize counter C55 (Connect) to 1;

4. shall reserve the media channel resources if not yet reserved; and

5. shall enter the 'G: Pre-established session in use' state.

NOTE 2: The case of manual answer is described in 3GPP TS 24.379 [2].

9.3.2.3.4 Pre-established session stopped

When the pre-established session between the MCPTT client and the participating MCPTT function is released, the participating MCPTT function:

1. shall release any media plane resources and timers associated with this pre-established session; and,

2. shall enter the 'Start-stop' state

9.3.2.3.5 Receive SIP 200 (OK) response to the SIP re-INVITE request (R: 200 OK)

Upon receiving the SIP 200 (OK) response to the SIP re-INVITE request of the pre-established session a call as specified in 3GPP TS 24.379 [2] (call setup with manual answer with pre-established session) the participating MCPTT function:

1. shall send the Connect message to the invited MCPTT client(s) using the media plane control transport channel defined for this call. The Connect message:

   a. shall include the SIP URI received in the Contact header field of the SIP INVITE request in the <MCPTT Session Identity> value in the MCPTT Session Identity field;

   b. if the SIP INVITE request included an "application/vnd.3gpp.mcptt-info+xml" MIME body with the <session-type> element set to a value of "prearranged" or "chat":

      i. shall include the received P-Asserted-Identity header field in the MCPTT Group Identity field; and

      ii. shall include the value 'prearranged' or 'chat' in the <Session Type> value in the MCPTT Session Identity field;

   c. if the SIP re-INVITE request included an "application/vnd.3gpp.mcptt-info+xml" MIME body with the <session-type> element set to a value of "private":

      i. may include the MCPTT ID of the inviting MCPTT user in the Inviting MCPTT User Identity field, if available from the SIP re-INVITE message and privacy of the inviting MCPTT ID is not required;

      ii. may include 'anonymous@anonymous.invalid' in the Inviting MCPTT User Identity field if the MCPTT ID of the inviting MCPTT user is not available from the SIP re-INVITE message or privacy of the inviting MCPTT ID is required; and

      iii. shall include the value 'private' in the <Session Type> value in the MCPTT Session Identity field;

   d. if the SIP re-INVITE request did not include an "application/vnd.3gpp.mcptt-info+xml" MIME body with the <session-type> element:

      i. may include the MCPTT ID of the inviting MCPTT user in the Inviting MCPTT User Identity field if available from the SIP re-INVITE message and privacy of the inviting MCPTT ID is not required; and

      ii. shall include the value 'no session type' in the <Session Type> value in the MCPTT Session Identity field;

   e. shall include a Media Streams field, if the negotiated SDP in the pre-arranged session contains more media streams than required by the SDP in the SIP INVITE request; and

   NOTE: For example if the call is a private call without floor control the Media Streams field needs to be included with the <Control Channel> value set to '0'.

   f. should set the first bit in the subtype of the Connect message to '1' (Acknowledgment is required) as described in subclause 8.3.2;

2. shall start timer T55 (Connect);

3. shall initialise counter C55 (Connect) to 1;
4. shall reserve the media channel resources if not yet reserved; and
5. shall enter the 'G: Pre-established session in use' state.

9.3.2.4 State: 'G: Pre-established session in use'

9.3.2.4.1 General

The 'G: Pre-established session in use' state is a stable state. The participating MCPTT function is in this state when a pre-established session is used for a call.

In this state the participating MCPTT function can receive RTP media packets and pre-established session call control messages.

9.3.2.4.2 Receive floor control message (R: Floor control message)

Upon receiving a floor control message the participating MCPTT function:

1. shall perform the actions in subclause 6.4.1; and
2. shall remain in the 'G: Pre-established session in use' state.

9.3.2.4.3 Receive RTP media packets (R: RTP Media)

Upon receiving an RTP media packet the participating MCPTT function:

1. shall perform the actions in subclause 6.4.1; and
2. shall remain in the 'G: Pre-established session in use' state.

9.3.2.4.4 Receive call session release indication from MCPTT client (R: Call Release from MCPTT client)

Upon receiving an indication from the MCPTT client that the call is released but the pre-established session is kept alive (see 3GPP TS 24.379 [2]), the participating MCPTT function:

1. shall send call release to the controlling MCPTT function as specified in 3GPP TS 24.379 [2];
2. may release the media resources associated with the call not needed for the pre-established session;
3. shall stop timer T55 (Connect); and
4. shall enter the 'G: Pre-established session not in use' state.

9.3.2.4.5 Receive call session release indication from the controlling MCPTT function (R: Call Release from MCPTT server)

Upon receiving an indication from the controlling MCPTT function that the call is released (see 3GPP TS 24.379 [2]), the participating MCPTT function:

1. shall stop timer T55 (Connect)if running;
2. shall send Disconnect message to the MCPTT client. The Disconnect message:
   a. shall include the MCPTT Session Identity field with the same content as sent in the Connect message when the MCPTT call was established; and
   b. should set the first bit in the subtype of the Disconnect message to '1' (Acknowledgment is required) as described in subclause 8.3.2;
3. shall start timer T56 (Disconnect);

4. shall initialise counter C56 (Disconnect) to 1;and
5. shall enter the 'G: Call releasing' state.

9.3.2.4.6 Receive pre-established session stopped indication from the MCPTT client (R: Pre-established Session Stopped from MCPTT client)

Upon receiving the pre-established session release indication (see 3GPP TS 24.379 [2]) from the MCPTT client. The participating MCPTT function:

1. shall stop sending RTP media packet and floor control messages between the MCPTT client and the controlling MCPTT function;
2. shall release any media plane resources and timers associated with this pre-established session; and
3. shall enter the 'Start-stop' state.

9.3.2.4.7 Receive Acknowledgment message ((R: successful Ack) or (R: failure Ack))

Upon receiving an Acknowledgment message from the MCPTT client, the participating MCPTT function:

1. shall stop timer T55 (Connect);
2. if the Reason Code is not 'Accepted' the participating MCPTT function:
   a. shall send Disconnect message to the MCPTT client;
      i. shall include the MCPTT Session Identity field with the same content as sent in the Connect message when the MCPTT call was established; and
      ii. should set the first bit in the subtype of the Disconnect message to '1' (Acknowledgment is required) as described in subclause 8.3.2;
   b. shall start timer T56 (Disconnect);
   c. shall initialise counter C56 (Disconnect) to 1;
   d. shall send a call release indication to the controlling MCPTT function (see 3GPP TS 24.379 [2]); and
   e. shall enter the 'G: Call releasing' state; and
3. otherwise the participating MCPTT function:
   a. shall send a SIP 200 (OK) response to the SIP INVITE request as specified in 3GPP TS 24.379 [2] if the SIP 200 (OK) response to the SIP INVITE request is not already sent; and
   b. shall remain in the 'G: Pre-established session in use' state.

9.3.2.4.8 Timer T55 (Connect) expired

On the expiry of timer T55 (Connect) the participating MCPTT function:

1. shall retransmit the Connect message sent to the MCPTT client using the media plane control transport channel defined for this MCPTT call;
2. shall start timer T55 (Connect);
3. shall increment counter C55 (Connect) by 1; and
4. shall remain in the 'G: Pre-established session in use' state.

9.3.2.4.9 Timer T55 (Connect) expired N times

When timer T55 (Connect) expires by the upper limit of counter C55 (Connect) times, the participating MCPTT function:

1. shall send a call release indication to the controlling MCPTT function as specified in 3GPP TS 24.379 [2];
2. may release the media resources associated with the call not needed for the pre-established session; and
3. shall enter the 'G: Pre-established session not in use' state.

9.3.2.4.10 Receive SIP 200 (OK) response (R: 200 OK)

Upon receiving a SIP 200 (OK) response from the controlling MCPTT function, the participating MCPTT function:

1. shall send the Connect message to the MCPTT client which initiated this call using the media plane control transport channel defined for this call. The Connect message:
   a. shall include the SIP URI received in the Contact header field of the SIP 200 (OK) response in the <MCPTT Session Identity> value in the MCPTT Session Identity field;
   b. if an "application/vnd.3gpp.mcptt-info+xml" MIME body with an <session-type> element is included in the SIP 200 (OK) response, shall include the <Session Type> value in the MCPTT Session Identity field with a value corresponding to the <session-type> element;
   c. if an "application/vnd.3gpp.mcptt-info+xml" MIME body with an <session-type> element is not included in the SIP 200 (OK) response, shall include the <Session Type> value set to 'no session type' in the MCPTT Session Identity field;
   d. if a Warning header field with set to the value "399" is received in the SIP 200 (OK) response, shall include the content of the "warn-text" parameter in the Warn Text header field;
   e. if a P-Answer-State header field is included in the SIP 200 (OK) response, shall include an Answer State field with a value corresponding to the "answer-type" parameter; and
   f should set the first bit in the subtype of the Connect message to '1' (Acknowledgment is required) as described in subclause 8.3.2;
2. shall start timer T55 (Connect);
3. shall increment counter C55 (Connect) by 1; and,
4. shall remain in the 'G: Pre-established session in use' state.

9.3.2.4.11 Receive failed SIP response from the controlling MCPTT function (R: Call Release from the MCPTT server)

Upon receiving a failed call setup indication from the controlling MCPTT function, the participating MCPTT function:

1. shall send an Disconnect message to the MCPTT client;
   a. shall include the MCPTT Session Identity field with the same content as sent in the Connect message when the MCPTT call was established; and
   b. should set the first bit in the subtype of the Disconnect message to '1' (Acknowledgment is required) as described in subclause 8.3.2;
2. shall start timer T56 (Disconnect);
3. shall initialise counter C56 (Disconnect) to 1;
4. shall terminate the call; and
5. shall enter the 'G: Call releasing' state.

9.3.2.5 State: 'G: Call releasing'

9.3.2.5.1 General

The 'G: Call releasing' state is a transition state. The participating MCPTT function is in this state when a call is being released by keeping the pre-established session.

Timer T56 (Disconnect) is running in this state.

9.3.2.5.2 Receive Acknowledgment message (R: Ack)

Upon receiving an Acknowledgment message from the MCPTT client, the participating MCPTT function:

1. shall stop timer T55 (Connect), if running;
2. shall stop timer T56 (Disconnect);
3. may release the media resources associated with the call not needed for the pre-established session; and
4. shall enter the 'G: Pre-established session not in use' state.

9.3.2.5.3 Timer T56 (Disconnect) expired

On the expiry of timer T56 (Disconnect) less than the upper limit of counter C56 (Disconnect) times, the participating MCPTT function:

1. shall retransmit the Disconnect message sent to the MCPTT client using the media plane control transport channel defined for this call;
2. shall start timer T56 (Disconnect);
3. shall increment counter C56 (Disconnect) by 1; and
4. shall remain in the 'G: Call releasing' state.

9.3.2.5.4 Timer T56 (Disconnect) expired N times

When timer T56 (Disconnect) expires by the upper limit of counter C56 (Disconnect) times, the participating MCPTT function:

1. may release the media resources associated with the call not needed for the pre-established session; and
2. shall enter the 'G: Pre-established session not in use' state.

10 MBMS subchannel control procedure

10.1 General

A participating MCPTT function sending floor control messages and RTP media packets over a MBMS bearer shall support the procedures in the following subclauses.

The MBMS bearer can be used for conversations in group calls. Prior to using the MBMS bearer the participating MCPT function need to activate the MBMS bearer and announce the MBMS bearer as described in subclause 4.1. 3.

Floor control messages and RTP media packets received over the MBMS subchannel are used as input to the floor participant state machine in the same way as floor control messages and RTP media packets received over the unicast bearer.

Media plane security procedures for media and floor control messages sent over the MBMS subchannels are specified in clause 13.

10.2 MBMS subchannel control procedure for the participating MCPTT function

10.2.1 General

If the participating MCPTT function supports MBMS subchannel control procedure, the participating MCPTT function shall support the behaviour implied by the state machine specified in this subclause. The specifications are on the reception of floor control messages from the controlling MCPTT function, sending of floor control messages and the allocation/deallocation of a MBMS subchannel for a conversation in a group session.

Figure 10.2.1-1 shows the participating MCPTT function MBMS subchannel control state diagram.

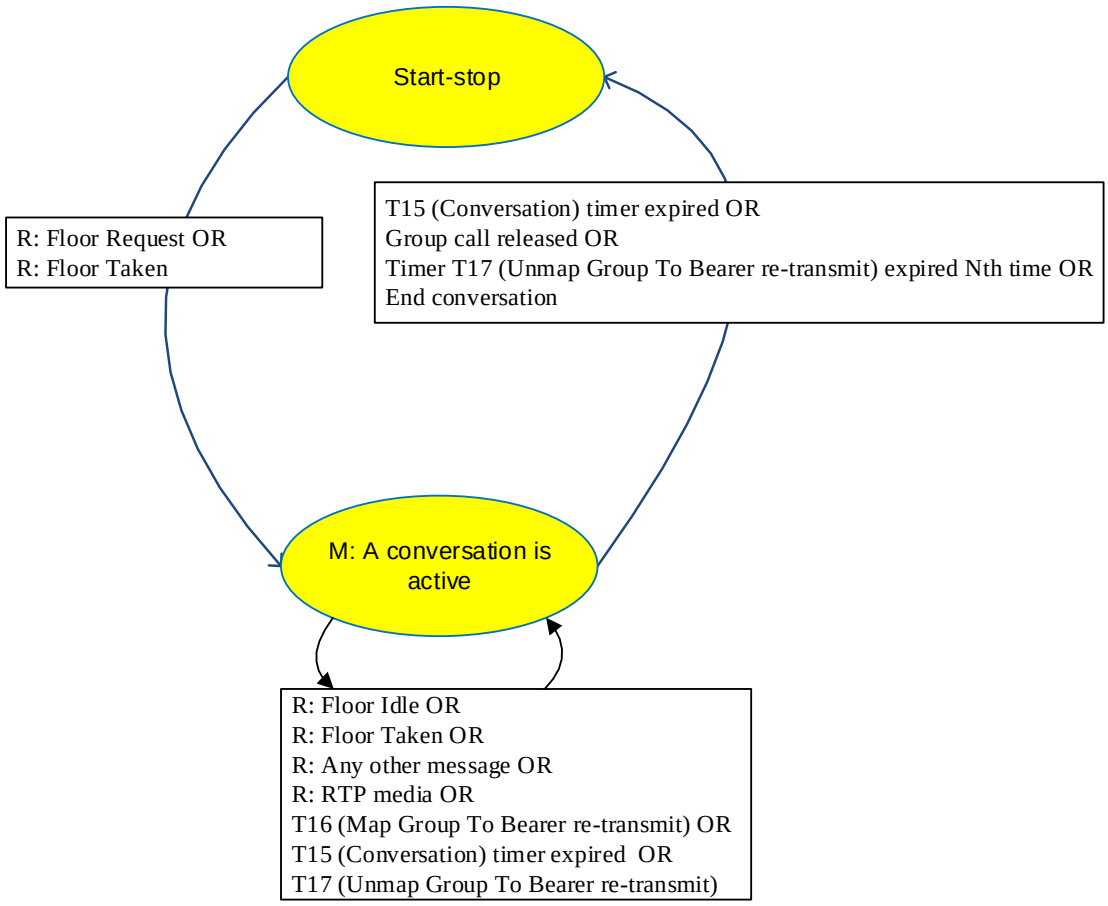


Figure 10.2.1-1: Participating MCPTT function MBMS subchannel control state diagram

If a floor control message or RTP media packet arrives in a state where there are no procedures specified in the subclauses below, the participating MCPTT function shall discard the message.

10.2.2 State: 'Start-stop'

10.2.2.1 General

In this state:

- no instance of the 'Participating MCPTT function MBMS subchannel control state machine exists;
- a pre-activated MBMS bearer may exist;

- no conversation using a MBMS subchannel control is active but a group session exists where a conversation over the unicast channel may be ongoing; and
- the participating MCPTT function handles floor control messages and RTP media packets as for during normal operations described in subclause 6.4.

10.2.2.2 Send Map Group To Bearer message (R: Floor Request or Floor Taken)

Upon receiving a Floor Request message or a Floor Taken message and when the participating MCPTT function decides that a MBMS subchannel shall be used for a conversation in an ongoing group session, the participating MCPTT function:

NOTE: The participating MCPTT function can take that decision when receiving the first Floor Request from a floor participant or when receiving a Floor Taken message destined to one of the floor participants served by the participating MCPTT client.

1. shall create an instance of the 'Participating MCPTT function MBMS subchannel control' state machine;
2. shall send a Map Group To Bearer message over the general purpose MBMS subchannel. The Map Group To Bearer message:
   a. shall include TMGI;
   b. shall include the identifier of the media stream; and
   c shall include the MCPTT Group identifier field;
3. shall start timer T15 (conversation);
4. shall start timer T16 (Unmap Group To Bearer);
5. shall enter the 'M: A conversation is active' state;
6. if the Floor Request was received, shall perform actions as described in subclause 6.4; and
7. if the Floor Taken was received, shall perform the actions described in subclause 10.2.3.3.

10.2.3 State: 'M: A conversation is active'

10.2.3.1 General

In this state a MBMS subchannel exists and can be used by a group call.

In this state a conversation is active and Floor Taken and Floor Idle messages and RTP media packets shall be sent over the MBMS subchannel.

In this state timer T15 (Conversation) and timer T16 (Map Group To Bearer re-transmit) are running.

In this state the timer T17 (Unmap Group To Bearer) may be running.

10.2.3.2 Send Floor Idle message (R: Floor Idle)

When a Floor Idle message destined to a floor participant listening to the MBMS subchannel is received, the participating MCPTT function:

1. shall for each received Floor Idle message, check if there is a stored message-sequence-number value associated with the conversation;
2. if a message-sequence-number value associated with the conversation is stored, compared the value of the stored message-sequence-number value with the value in the received Floor Idle message;
   a. if the received message-sequence-number value is higher than the stored value:

i. shall replace the stored message-sequence-number value with the received message-sequence-number field;

ii. shall set the acknowledgment bit to '0' as specified in subclause 8.2.2, if not already set; and

iii. shall send the received Floor Idle message over the MBMS subchannel; and

b. if the received message-sequence-number value is lower or the same as the stored value, shall discard the received Floor Idle message;

3. if a message-sequence-number value associated with the conversation is not stored (i.e. this is the first floor control message received in the conversation):

a. shall store the received message-sequence-number value and associate the value with the conversation;

b. shall set the acknowledgment bit to '0' as specified in subclause 8.2.2, if not already set; and

c. shall send the received Floor Idle message over the MBMS subchannel;

4. if the received Floor Idle message indicates that a Floor Ack message is expected (i.e. the acknowledgment bit is set to '1' as specified in subclause 8.2.2), shall send a Floor Ack message towards the controlling MCPTT function with the Source field set to '1' (participating MCPTT function is the source);

5. restart timer T15 (conversation); and

6. remain in the 'M: A conversation is active' state.

10.2.3.3 Send Floor Taken message (R: Floor Taken)

When a Floor Taken message destined to a floor participant listening to the MBMS subchannel is received, the participating MCPTT function:

1. shall for each received Floor Taken message, check if there is a stored message-sequence-number value associated with the conversation;

2. if a message-sequence-number value associated with the conversation is stored, compare the value of the stored message-sequence-number value with the value in the received Floor Taken message;

a. if the received message-sequence-number value is higher than the stored value:

i. shall replace the stored message-sequence-number value with the received message-sequence-number field;

ii. shall set the acknowledgment bit to '0' as specified in subclause 8.2.2, if not already set; and

iii. shall send the received Floor Taken message over the MBMS subchannel; and

b. if the received message-sequence-number value is lower or the same as the stored value, shall discard the received Floor Taken message;

3. if a message-sequence-number value associated with the conversation is not stored (i.e. this is the first floor control message received in the conversation):

a. shall store the received message-sequence-number value and associate the value with the conversation;

b. shall set the acknowledgment bit to '0' as specified in subclause 8.2.2, if not already set; and

c. shall send the received Floor Taken message over the MBMS subchannel;

4. if the received Floor Taken message indicates that a Floor Ack message is expected (i.e. the acknowledgment bit is set to '1' as specified in subclause 8.2.2), shall send a Floor Ack message towards the controlling MCPTT function with the Source field set to '1' (participating MCPTT function is the source);

5. restart timer T15 (conversation); and

6. remain in the 'M: A conversation is active' state.

10.2.3.4 Send any other floor control message (R: Any other message)

When a floor control message other than the Floor Idle and Floor Taken message is received from a floor participant or received from the floor control server, the participating MCPTT function:

1. shall forward the floor control message as specified in subclause 6.4;
2. restart timer T15 (conversation); and
3. remain in the 'M: A conversation is active' state.

10.2.3.5 Send RTP media packet over the MBMS subchannel (R: RTP packet)

When receiving a RTP media packet destined to one of the MCPTT client listening to the MBMS subchannel, the participating MCPTT function:

NOTE: An RTP media packet not destined to an MCPTT client listening to the MBMS subchannel is forwarded to the MCPTT client over the unicast bearer.

1. check if the media packet is already sent over the MBMS subchannel or not;
2. if the RTP media packet is already sent over the MBMS subchannel, shall discard the RTP media packet;
3. if the RTP media packet is not already sent over the MBMS sub channel, shall instruct the media distribution function to send the RTP media packet over the MBMS subchannel;
4. restart timer T15 (Conversation); and
5. remain in the 'M: A conversation is active' state.

10.2.3.7 Timer T15 (conversation) expired

Upon expiry of timer T15 (Conversation), the participating MCPTT function shall:

1. if the application indicates that there is no longer an MCPTT client listening to the MBMS bearer,
   a. shall release the instance of the 'Participating MCPTT function MBMS subchannel management' state machine used for the conversation; and
   b. shall enter the 'Start-stop' state; and
2. if the application indicates that there are MCPTT client still listening to the MBMS bearer:
   a. shall send the Unmap Group To Bearer message over the MBMS subchannel. The Unmap Group To Bearer message:
      i. shall include the MCPTT Group ID field;
   b. shall start timer T17 (Unmap Group To Bearer) and initialise counter C17 (Unmap Group To Bearer) to 1; and
   c. shall remain in the 'M: A conversation is active' state.

10.2.3.8 Timer T16 (Map Group To Bearer) expired

Upon expiry of timer T16 (Map Group To Bearer), the participating MCPTT function:

1. shall send a Map Group To Bearer message over the general purpose MBMS subchannel. The Map Group To Bearer message:
   a. shall include a TMGI field;
   b. shall include a MBMS Subchannel field; and
   c shall include the MCPTT Group identifier field;

2. restart timer T16 (Map Group To Bearer); and

3. remain in the 'M: A conversation is active' state.

10.2.3.9 Timer T17 (Unmap Group To Bearer) expired

Upon expiry of timer T17 (Unmap Group To Bearer) less than the upper limit of counter C17 (Unmap Group To Bearer) times, the participating MCPTT function:

1. shall send the Unmap Group To Bearer message over the MBMS subchannel. The Unmap Group To Bearer message:

   a. shall include the MCPTT Group ID field; and

2. shall restart the timer T17 (Map Group To Bearer re-transmit) and increment counter C17 (Unmap Group To Bearer) by 1.

10.2.3.10 Timer T17 (Unmap Group To Bearer) expired Nth time

Upon expiry of timer T17 (Unmap Group To Bearer) by the upper limit of counter C17 (Unmap Group To Bearer), the participating MCPTT function:

1. shall send the Unmap Group To Bearer message over the MBMS subchannel. The Unmap Group To Bearer message:

   a. shall include the MCPTT Group ID field; and

2. shall release the instance of the 'Participating MCPTT function MBMS subchannel management' state machine used for the conversation.

10.2.3.11 End conversation over the MBMS bearer (End conversation)

Upon receiving an indication from the application and signalling plane that all MCPTT clients now listens to the unicast channel, the participating MCPTT function:

1. shall release the instance of the 'Participating MCPTT function MBMS subchannel management' state machine used for the conversation.

10.2.3.12 Group call released

If the control and signalling plane indicates that the group call session is released, the participating MCPTT function:

1. shall send the Unmap Group To Bearer message over the MBMS subchannel. The Unmap Group To Bearer message:

   a. shall include the MCPTT Group ID field;

2. shall stop timer T15 (conversation), timer T16 (Map Group To Bearer) and timer T17 (Unmap Group To Bearer), if running; and

3. shall release the instance of the 'Participating MCPTT function MBMS subchannel management' state machine used for the conversation.

10.3 MBMS subchannel control procedure for the MCPTT client

10.3.1 General

An MCPTT client that supports receiving floor control messages and RTP media packets over an MBMS bearer shall support the procedures in the following subclauses.

The procedures in the following subclauses assume that an MBMS bearer is active and announced as described in subclause 4.1.3.

NOTE: The floor control procedures described in subclause 6.2 are not impacted due to the use of an MBMS bearer.

10.3.2 Conversation over a pre-activated MBMS bearer is started

When receiving a Map Group To Bearer message over the general purpose MBMS subchannel, the MBMS interface in the MCPTT client:

1. shall associate the TMGI in the TMGI field, the MBMS subchannel for audio and for floor control with the MCPTT group identity in the MCPTT Group ID field.

10.3.3 Receive floor control messages and RTP media packets over a MBMS subchannel

If the MBMS interface receives RTP media packets or floor control messages over the MBMS subchannel, the MBMS interface in the MCPTT client:

1. if there is an association between the TMGI, the MBMS subchannel for audio and for floor control to an ongoing conversation in a group session:

   a. shall forward the received floor control messages to the floor participant in the conversation; and

   b. if the received RTP medias contains a different SSRC value than the SSRC value used by the MCPTT client, shall forward the received RTP packets to the media mixer in the conversation; and

2. if there is no such association:

   a. shall ignore the received floor control message or received RTP media packet.

10.3.4 Conversation ended

When receiving the Unmap Group To Bearer message over a MBMS subchannel, the MBMS interface in the MCPTT client:

1. shall remove the association between the TMGI, the MBMS subchannel for audio and for floor control from the conversation in the group session identified by the MCPTT Group ID field, if such an association exists.

11 Configurable parameters

11.1 Timers

11.1.1 Timers in the on-network floor participant

The table 11.1.1-1 recommends timer values, describes the reason for of starting the timer, normal stop and the action on expiry for the on-network floor participant procedures.

Table 11.1.1-1: Timers in the on-network floor participant

Timer	Timer value	Cause of start	Normal stop	On expiry
T100 (Floor Release)	Configurable as specified in 3GPP TS 24.383 [4]. (NOTE 1)	When the floor participant sends a Floor Release message.	Reception of a Floor Idle message or when the floor participant detects the receipt of RTP media.	If the counter is less than the upper limit of C100, a new Floor Release message is sent and counter is incremented by 1. When the limit in C100 is reached, the floor participant stops sending the Floor Release message.
T101 (Floor Request)	Configurable as specified in 3GPP TS 24.383 [4]. (NOTE 2)	When the floor participant sends a Floor Request message. T101 is also started when the application layer and signalling plane initiates a session as an implicit floor request using the "mc_implicit_request" as specified in clause 14.	Reception of a Floor Granted message, a Floor Taken message, a Floor Deny message, a Floor Queue Position Info message or when the floor participant receives RTP media from another floor participant.	When T101 expires, a new Floor Request message is sent.
T103 (end of RTP media)	Should be equal to T1. Configurable as specified in 3GPP TS 24.383 [4].	Reception of a Floor Taken message or an RTP media packet. T13 is reset and started again every time an RTP media packet is received.	The reception of a Floor Idle message.	When T103 expires the floor control client concludes that the RTP media, which it was started for, has completed.
T104 (Floor Queue Position Request)	Configurable as specified in 3GPP TS 24.383 [4]. T14 shall only permit a certain number of retransmissions of the Floor Queue Position Request message.	When the floor participant sends a Floor Queue Position Request message.	Reception of a Floor Queue Position Info message.	If the counter is less than the upper limit of C104, a new Floor Queue Position Request message is sent and counter is incremented by 1. When the limit in C104 is reached, the floor participant stops sending the Floor Queue Position Request message.
T132 (Queued granted user action)	Default value: 2 seconds. Configurable as specified in 3GPP TS 24.383 [4].	When the floor participant receives a Floor Granted message for a queued request.	When a floor participant in "U: queued" state pushes PTT button.	The floor participant sends a Floor Release message and may indicate to the user that the floor is no more available
T133 (pending user action)	Default value: 3 seconds Maximum value: 5 seconds Configurable	Reception/Transmission of a Floor Granted message for a queued request.	When a floor participant in "O: queued" state pushes PTT button. Reception of RTP media packet from granted floor participant in "O: pending granted"	Assume the participant is out of coverage or doesn't want to speak anymore. Grant to next in queue if any, otherwise assume silence.

NOTE 1: The total time during which the floor participant retransmits the Floor Release messages shall be less than 6 seconds.
NOTE 2: The total time during which the floor participant retransmits Floor Request messages should be less than 6 seconds.

11.1.2 Timers in the off-network floor participant

The table 11.1.2-1 recommends timer values, describes the reason for of starting the timer, normal stop and the action on expiry for the off-network floor participant procedures.

Table 11.1.2-1: Timers in the off-network floor participant

Timer	Timer value	Cause of start	Normal stop	On expiry
T201 (Floor Request)	Default value: 40 milliseconds Depends on the characteristic of the D2D. (D2D Side link period) T201 shall permit only a certain number of retransmissions of the Floor Request message.	When the floor participant sends a Floor Request message	Reception of a Floor Granted message or a Floor Deny message or a Floor Queue Position Info message or when the MCPTT user releases the PTT button.	If the counter is less than the upper limit of C201, a new Floor Request message is sent and counter is incremented by 1. When the limit in C201 is reached, the floor participant stops sending the Floor Request message.
T203 (end of RTP media)	Default value: 4 seconds Maximum value: 6 seconds Configurable as specified in 3GPP TS 24.383 [4].	When the floor participant sends an RTP media packet. T203 is also reset and started again every time an RTP media packet is received or when the floor participant enters "O: has no permission"	Reception of a Floor Release message or a Floor Granted to me or when the floor participant enters "O: has permission"	When T203 expires the floor participant concludes that there is no floor arbitrator at present.
T204 'Floor Queue Position Request)	Default value: 80 milliseconds Depends on the characteristic of the D2D. (D2D Side link period*2) T205 shall permit only a certain number of retransmissions of the Floor Granted message.	When the floor participant sends a Floor Queue Position Request message.	Reception of the Floor Queue Position Info message.	If the counter is less than the upper limit of C204, a new Floor Queue Position Request message is sent and counter is incremented by 1. When the limit in C204 is reached, the floor participant stops sending the Floor Queue Position Request message.
T205 (Floor Granted)	Default value: 80 milliseconds Depends on the characteristic of the D2D. (D2D Sidelink period*2) T205 shall permit only a certain number of retransmissions of the Floor Granted message.	When the floor arbitrator grants the permission to send media to a floor participant, which was a pre-empting floor request.	Reception of an RTP media packet from granted floor participant in "O: pending granted"	If the counter is less than the upper limit of C205, a new Floor Granted message is sent and counter is incremented by 1. When the limit in C205 is reached, the floor arbitrator stops sending the Floor Granted message.
T230 (during silence)	Default value: 600 seconds. Value should be more than T203.	When the floor participant sends an RTP media packet. T230 is also reset and started again every time an RTP media packet is received. or when the floor participant leaves "O: has permission"	Release of the call. or, when the floor participant enter "O: has permission	The floor control entity is released.

Timer	Timer value	Cause of start	Normal stop	On expiry
T233 (Pending user action)	Default value: 3 seconds Maximum value: 5 seconds Configurable The total time (T25*C25+ T233) during which the floor arbitrator retransmits Floor Granted message and waits for user to accept floor should be less than T203	Reception/Transmission of q Floor Granted message for a queued request.	When a floor participant in "O: queued" state pushes PTT button. Reception of RTP media packet from granted floor participant in "O: pending granted"	Assume the participant is out of coverage or doesn't want to speak anymore. Grant to next in queue if any, otherwise assume silence.

11.1.3 Timers in the floor control server

The table 11.1.3-1 recommends timer values, describes the reason for of starting the timer, normal stop and the action on expiry for the floor control server procedures.

Table 11.1.3-1: Timers in the floor control server.

TIMER	TIMER VALUE	CAUSE OF START	NORMAL STOP	ON EXPIRY
T1 (end of RTP media)	Default value: 4 seconds Maximum value: 6 seconds Configurable (NOTE 1, NOTE 2)	Transmission of either a SIP message that includes an optional "mc_granted" fmtp attribute, or a Floor Granted message to the floor participant that are given permission to send media or when RTP media packets are received.	Reception of the last RTP media packet and a Floor Release message. (NOTE 3)	When T1 expires it is concluded that the granted floor request, which it was started for, has been completed.
T2 (Stop talking timer)	Default maximum value: 30 seconds.	Detection of an RTP media packet.	Detection of the completion of media.	When T2 expires it is concluded that the floor participant that has permission to send media has talked too long.
T3 (Stop talking grace)	Default value: 3 seconds.	Expiry of T2.	Reception of a Floor Release message from the floor participant that has permission to send media. (NOTE 4)	When T3 expires, the floor participant that talked too long is penalized and put in a waiting state in which it cannot be granted the right to speak.
T4 (inactivity)	Default value: 30 seconds.	When the floor control server enters the 'G: 'Floor idle' state.	A floor participant requests the permission to send media.	The MCPTT call is released.
T7 (Floor Idle)	Default value: Depends on the characteristic of the radio access network.	The transmission of a Floor Idle message to the floor participants in the MCPTT call.	The stop can be supervised by a timer (out of scope of this specification). The recommended value of this timer is the same value as the value of the T15 (conversation) timer.	When T7 expire the floor control server sends another Floor Idle message to the floor participants.
T8 (Floor Revoke)	Default value: 1 second. Configurable.	A Floor Revoke message is sent to a floor participant with the permission to send media.	Expiry of T3 or reception of a Floor Release message from the revoked floor participant.	Send another Floor Revoke message to the floor participant and reset and start T8 again.
T20 (Floor Granted)	Default value: 1 second Configurable. (NOTE 5)	When the floor control server grants the permission to send media to a floor participant, which was queued and which negotiated queueing. T20 is also started again when the floor control server sends a Floor Granted message upon T20 expiry.	Reception of an RTP Media packet or when the MCPTT client is losing its permission to send media.	When T20 expires, a new Floor Granted message is sent unless the total time as limited by T1 is reached.

NOTE 1: The minimum value (Min) should be greater than the expected round trip delay from floor control server to the remote floor participant. Special consideration should be given to over-the-air connections that introduce significant transmission latency due to low bandwidth.
NOTE 2: T1 can be set to higher value than normally when a queued MCPTT client is granted the permission to send media.
NOTE 3: If the Floor Release message does not include the sequence number of the last RTP media packet, T1 is stopped on the reception of the Floor Release message.
NOTE 4 If the Floor Release message doesn't include the sequence number of the last RTP packet the T3 is stopped on the reception of the MBCP Media Burst Release message.
NOTE 5 T20 shall only permit a certain number of retransmissions of the Floor Granted message. The total time during which the floor control server retransmits the Floor Granted messages is limited by T1.

11.1.4 Timers in the participating MCPTT function

The table 11.1.4-1 and table 11.1.4-2 recommends timer values, describes the reason for of starting the timer, normal stop and the action on expiry.

Table 11.1.4-1 shows the timers used in the call over pre-established session procedures in the participating MCPTT function.

Table 11.1.4-1: Timers in the participating MCPTT function for pre-established session control.

TIMER	TIMER VALUE	CAUSE OF START	NORMAL STOP	ON EXPIRY
T55 (Connect)	Default value: 2 seconds Maximum value: 4 seconds Configurable	Transmission of 'Connect' message by the participating MCPTT function	Reception of an Acknowledgement to the Connect message	On the expiry of this timer less than a configurable number of times the 'Connect' message is resent.
T56 (Disconnect)	Default value: 2 seconds Maximum value: 4 seconds Configurable	Transmission of 'Disconnect' message by the participating MCPTT function.	Reception of an Acknowledgement message to the Disconnect message.	On the expiry of this timer less than a configurable number of times the 'Disconnect' message is resent.

Table 11.1.4-2 shows the timers used in the participating MCPTT function for MBMS channel control.

Table 11.1.4-2: Timers in the participating MCPTT function for MBMS channel control.

TIMER	TIMER VALUE	CAUSE OF START	NORMAL STOP	ON EXPIRY
T15 (conversation)	Default value: 30 seconds Configurable	Transmission of Map Group To Bearer message. Restarted when an RTP packet or a floor control message is sent.	Release of the call.	Send Unmap Group To Bearer message.
T16 (Map Group To Bearer)	Default value: 500 milliseconds Configurable	Transmission of Map Group To Bearer message.	Release of the call (or MBMS Subchannel).	Send Map Group To Bearer message.
T17 (Unmap Group To Bearer)	Default value: 200 milliseconds Configurable	Transmission of Unmap Group To Bearer message.	Release of the call.	Send Unmap Group To Bearer message.

11.2 Counters

11.2.1 Counters in the on-network floor participant

Table 11.2.1-1 enlists counters, their limits and the action on expiry.

Table 11.2.1-1: Counter used in the floor participant for on-network floor control

Counter	Limit	Associated timer	On reaching the limit
C100 (Floor Release)	Default value: 3	T100 (Floor Release)	Floor Release message is no more repeated
C101 (Floor Request)	Default value: 3	T101 (Floor Request)	Floor Request message is no more repeated
C104 (Floor Queue Position Request)	Default value: 3	T104 (Floor Queue Position Request)	Floor Queue Position Request message is no more repeated

11.2.2 Counters in the off-network floor participant

The table 11.2.2-1 enlists counters, their limits and the action on expiry.

Table 11.2.1.2-1: Counter used in the floor participant for off-network floor control

Counter	Limit	Associated timer	On expiry
C201 (Floor Request)	Default value: 3	T201 (Floor Request)	Assume there is no floor arbitrator and send Floor Granted (to me) message
C204 (Floor Queue Position Request)	Default value: 3	T204 (Floor Queue Position Request)	Floor Queue Position Request message is no more repeated
C205 (Floor Granted)	Default value: 4	T205 (Floor Granted)	If there is a pending request(s) in the queue, start timer T233 (pending user action) and wait for RTP media from the client.

11.2.3 Counters in the controlling MCPTT function

The table 11.2.3-1 enlists counters, their limits and the action on expiry for the 'general control operation' state machine in the controlling MCPTT function.

Table 11.2.3-1: Counters used in the 'general floor control operation' state machine

Counter	Limit	Associated timer	On reaching the limit
C7 (Floor Idle)	Default value: 10	T7 (Floor Idle)	The Floor Idle message is no more re-send
C20 (Floor Granted)	Default value: 3	T20 (Floor Granted)	The Floor Granted message is no more re-send in case a queued floor participant is granted the floor.

11.2.4 Counters in the participating MCPTT function

The table 11.2.4-1 enlists counters, their limits and the action on expiry for the 'pre-established session state machine'.

Table 11.2.4-1: Counters used in the 'pre-established session state machine'

Counter	Limit	Associated timer	On reaching the limit
C55 (Connect)	Default value: 3	T55 (Connect)	The Connect message is no more re-send
C56 (Disconnect)	Default value: 3	T56 (Disconnect)	The Disconnect message is no more re-send

The table 11.2.4-2 enlists counters, their limits and the action on expiry for the 'Participating MCPTT function MBMS subchannel control state machine'.

Table 11.2.4-2: Counters used in the 'Participating MCPTT function MBMS subchannel control state machine'

Counter	Limit	Associated timer	On reaching the limit
C17 (Unmap Group To Bearer)	Default value: 3	T17 (Unmap Group To Bearer)	The Unmap Group To Bearer message is no more re-sent.

12 Extensions within the present document

12.1 Session description types defined within the present document

12.1.1 General

This subclause contains definitions for SDP parameters that are specific to SDP usage with MCPTT and therefore are not described in an RFC.

12.1.2 SDP "fmtp" attribute for MCPTT

12.1.2.1 General

This subclause defines the structure and syntax of the SDP "fmtp" attribute, when used to negotiate an MCPTT media plane control channel. The MCPTT media plane control channel, and the protocols used on the control channel, is described in the present specification.

12.1.2.2 Semantics

In an SDP offer and answer, the "mc_queueing" fmtp attribute is used to indicate support of the Floor Request message queueing mechanism, as defined in the present specification.

In an SDP offer, the "mc_priority" fmtp attribute indicates (using an integer value between '1' and '15') the maximum floor priority that the offerer requests to be used with Floor Request messages sent by the offerer. In an SDP answer, the attribute parameter indicates the maximum priority level that the answerer has granted to the offerer. The value must be equal or less than the value provided in the associated SDP offer.

NOTE 1: If the "mc_priority" fmtp attribute is not used within an SDP offer or answer, a default priority value is assumed.

In an SDP offer, the "mc_granted" fmtp attribute parameter indicates that the offerer supports the procedure where the answerer indicates, using the fmtp attribute in the associated SDP answer, that the floor has been granted to the offerer.

NOTE 2: When the "mc_granted" fmtp attribute is used in an SDP offer, it does not indicate an actual request for the floor. The SDP "mc_implicit_request" fmtp attribute can be used to request the floor. In an SDP answer, the attribute indicates that the floor has been granted to the offerer.

NOTE 3: Once the offerer has been granted the floor, the offerer has the floor until it receives a Floor Revoke message, or until the offerer itself releases the floor by sending a Floor Release message, as described in the present specification.

In an SDP offer, the "mc_implicit_request" fmtp attribute indicates that the offerer implicitly requests the floor (without the need to send a Floor Request message). In an SDP answer, the attribute parameter indicates that the answerer has accepted the implicit floor request. Once the answerer grants the floor to the offerer, the answerer will send a Floor Granted message.

NOTE 4: The usage of the "mc_implicit_request" fmtp attribute in an SDP answer does not mean that the answerer has granted the floor to the offerer, only that the answerer has accepted the implicit floor request.

12.1.2.3 Syntax

Table 12.1.2.3-1: SDP "fmtp" attribute for the MCPTT media plane control channel

```
fmtp-attr-mpcp      = "a=fmtp:" "MCPTT" SP attr-param-list
attr-param-list     =  attr-param *(COLON attr-param)
attr-param          =  mc_queueing / mc_priority / mc_granted / mc_implicit_request
mc_queueing          =  "mc_queueing"
mc_priority         =  "mc_priority=" 1*2(DIGIT)
mc_granted          =  "mc_granted"
mc_implicit_request =  "mc_implicit_request"
```

13 Media plane security

13.1 General

Media plane security provides confidentiality protection of individual media streams and media plane control messages in MCPTT sessions. The media plane security is based on 3GPP MCPTT security solution including key management and end-to-end media and floor control messages protection as defined in 3GPP TS 33.179 [14].

The Group Management Key (GMK) and the Group User Key Identifier (GUK-ID) is distributed to the MCPTT clients during the affiliation process specified in 3GPP TS 24.381 [12].

For private calls, the Private Call Key (PCK) and the Private Call Identifier (PCK-ID) are distributed as part of the establishment of the private call as described in 3GPP TS 24.379 [2].

13.2 Derivation of SRTP/SRTCP master keys

In group calls, the GMK shall be used as the MIKEY Traffic Generating Key (TGK) and the GUK-ID shall used as the MIKEY CSB ID as specified in IETF RFC 3830 [15].

In private calls, the PCK shall be used as the MIKEY Traffic Generating Key (TGK) and the PCK-ID shall used as the MIKEY CSB ID as specified in IETF RFC 3830 [15].

13.3 Media stream encryption and decryption

13.3.1 General

The Traffic-Encrypting Key (TEK) shall be generated as specified in IETF RFC 3830 [15] based on the TGK and MICKEY CSB ID derived as specified in subclause 13.2.

13.3.2 The participating MCPTT function

13.3.2.1 General

The participating MCPTT function obtains the GMK and the GUK-ID during the affiliation process specified in 3GPP TS 24.381 [12].

The participating MCPTT function is transparent to RTP media streams and forwards encrypted RTP media streams without decrypting the payload.

The participating MCPTT function encrypts RTP media packets and floor control messages sent over the MBMS subchannel for audio or floor control. The TEK is generated using the GMK and GUK-ID as specified in subclause 13.3.1.

The participating MCPTT function encrypts pre-established session control messages. The TEK is generated using the PCK and PCK-ID as specified in subclause 13.3.1.

13.3.2.2 Encryption of media streams over MBMS subchannels

When the participating MCPTT function receives an RTP media packet to be sent over a MBMS subchannel and the RTP media packet is not encrypted, the participating MCPTT function:

1. shall encrypt the RTP media packet sent over the MBMS subchannel for audio using SRTP as specified in IETF RFC 3711 [16] section 4.1; and

2. shall include the payload, SRTP MKI and authentication tag in accordance with IETF RFC 3711 [16] section 3.1.

When the participating MCPTT function receives a Floor Taken message or a Floor Idle message to be sent over a MBMS subchannel and the Floor Taken message or the Floor Idle message is not encrypted, the participating MCPTT function:

1. shall encrypt the Floor Taken message or the Floor Idle message sent over the MBMS subchannel for floor control using SRTCP as specified in IETF RFC 3711 [16] section 4.1; and

2. shall include the SRTCP index, SRTCP MKI and an authentication tag in accordance with IETF RFC 3711 [16] section 3.4.

NOTE: MBMS subchannel control messages sent over the general purpose MBMS subchannel are never encrypted.

13.3.2.3 Encryption and decryption of pre-established session call control messages

When the participating MCPTT function sends a pre-established session call control message, the participating MCPTT function:

1. may decide to encrypt the pre-established session call control message; and

2. if the pre-established session call control message is to be encrypted:

   a- shall encrypt the pre-established session call control message using SRTCP as specified in IETF RFC 3711 [16] section 4.1; and

   b. shall include the SRTCP index, SRTCP MKI and an authentication tag in accordance with IETF RFC 3711 [16] section 3.4.

When the participating MCPTT function receives an encrypted pre-established session call control message, the participating MCPTT function:

1. shall decrypt the received pre-established session call control message as specified in IETF RFC 3711 [16] section 4.

13.3.2.4 Forwarding of encrypted media streams over the MBMS subchannel

When the participating MCPTT function receives an RTP media packet potentially to be sent over a MBMS subchannel and the RTP media packet is already encrypted, the participating MCPTT function:

1. shall decide if the RTP media packet shall be sent over the MBMS subchannel for audio as specified in subclause 10.2.3.5; and

NOTE 1: The sequence number is not encrypted and can be used as the base for the decision without decrypting the RTP media packet.

2. if the RTP media packet shall be sent over the MBMS subchannel for audio, shall send the received RTP media packet over the MBMS subchannel for audio.

When the participating MCPTT function receives a Floor Taken message or a Floor Idle message potentially to be sent over a MBMS subchannel and the Floor Taken message or the Floor Idle message is already encrypted, the participating MCPTT function:

1. shall decrypt the received Floor Taken message or the received Floor Idle message as specified in IETF RFC 3711 [16] section 4 using the key obtained as specified in 3GPP TS 24.381 [12];

NOTE 2: The Message Sequence Number field is encrypted and can't be used as the base for the decision without decrypting the Floor Taken message or the Floor Idle message.

2. shall determine based on the Message Sequence Number field if the Floor Taken message or the Floor Idle message shall be sent over the MBMS subchannel for floor control as specified in subclauses 10.2.3.2 or 10.2.3.3; and

3. if the Floor Taken message or the Floor Idle message shall be sent over the MBMS subchannel, shall send the received Floor Taken message or the Floor Idle message over the MBMS subchannel for floor control.

13.3.2.5 Forwarding of encrypted media streams over the unicast bearer

When the participating MCPTT function receives an RTP media packet to be sent over the unicast bearer and the RTP media packet is already encrypted, the participating MCPTT function shall send the received RTP media packet as specified in subclause 6.4 without decrypting the RTP media packet.

When the participating MCPTT function receives a floor control message to be sent over the unicast bearer and the floor control message is already encrypted, the participating MCPTT function shall send the received floor control message as specified in subclause 6.4 without decrypting the RTP media packet.

13.3.3 The MCPTT client

13.3.3.1 Encryption of media streams

The MCPTT client is using the GMK and GUK-ID to generate the TEK in group calls.

The MCPTT client is using the PCK and PCK-ID to generate the TEK in private calls.

13.3.3.2 Encryption of media streams

When an RTP media stream shall be sent encrypted, the MCPTT client:

1. shall encrypt RTP media packets using SRTP as specified in IETF RFC 3711 [16] section 4.1; and

2. shall include the payload, SRTP MKI and authentication tag in accordance with IETF RFC 3711 [16] section 3.1.

When a floor control message or a pre-established session call control message shall be sent encrypted, the MCPTT client:

1. shall encrypt floor control message or the pre-established session call control message using SRTCP as specified in IETF RFC 3711 [16] section 4.1; and

2. shall include the SRTCP index, SRTCP MKI and an authentication tag in accordance with IETF RFC 3711 [16] section 3.4.

13.3.3.3 Decryption of media streams

On receipt of an encrypted RTP media packet, the MCPTT client:

1. shall decrypt the encrypted RTP media packet received over the MBMS subchannel for audio as specified in IETF RFC 3711 [16] section 3.3; and

On receipt of an encrypted floor control message or an encrypted pre-established session call control message, the MCPTT client:

2. shall decrypt the message as specified IETF RFC 3711 [16] section 4.

13.3.4 The controlling MCPTT function

13.3.4.1 General

The controlling MCPTT function obtains the GMK and the GUK-ID during the affiliation process specified in 3GPP TS 24.381 [12].

The controlling MCPTT function is transparent to encrypted media streams (RTP media packets) and forwards RTP media packets without decrypting the payload.

The controlling MCPTT function encrypts and decrypts floor control messages.

13.3.4.2 Encryption of floor control messages

When a floor control message shall be sent encrypted, the controlling MCPTT function:

1. shall the encrypt floor control message using SRTCP as specified in IETF RFC 3711 [16] section 4.1; and

2. shall include the SRTCP index, SRTCP MKI and an authentication tag in accordance with IETF RFC 3711 [16] section 3.4.

13.3.4.3 Decryption of floor control messages

On receipt of an encrypted floor control message, the controlling MCPTT function shall decrypt the floor control message as specified IETF RFC 3711 [16] section 4.13.3.4.4 Forwarding of encrypted RTP media streams

When the controlling MCPTT function receives an RTP media packet and the RTP media packet is already encrypted, the controlling MCPTT function shall distribute the received RTP media packet as specified in subclause 6.3 without decrypting the RTP media packet.

13.3.4 The non-controlling MCPTT function

13.3.4.1 General

The non-controlling MCPTT function obtains the GMK and the GUK-ID from GMS as specified in 3GPP TS 24.381 [12].

The non-controlling MCPTT function encrypts and decrypts floor control messages.

13.3.4.2 Decryption of floor control messages

On receipt of an encrypted floor control message, the controlling MCPTT function shall decrypt the encrypted floor control message as specified IETF RFC 3711 [16] section 4.

13.3.4.3 Encryption of floor control messages

When a floor control message shall be sent encrypted, the non-controlling MCPTT function:

1. shall encrypt floor control message using SRTCP as specified in IETF RFC 3711 [16] section 4.1; and
2. shall include the SRTCP index, SRTCP MKI and an authentication tag in accordance with IETF RFC 3711 [16] section 3.4.

13.3.4.4 Forwarding of encrypted RTP media streams

When the non-controlling MCPTT function receives an RTP media packet and the RTP media packet is already encrypted, the non-controlling MCPTT function shall distribute the received RTP media packet as specified in subclause 6.5 without decrypting the RTP media packet.

14. SDP offer/ answer procedures

14.1 General

The capabilities described in subclause 4.3 is negotiated in the signalling and application plane using SDP offer / answer in SIP requests or SIP responses as specified in 3GPP TS 24.379 [2].

This clause describes the details of the SDP offer / answer procedures with regards to the MCPTT fmtp attribute in the "m=application" m-line.

14.2 Generating an SDP offer

14.2.1 General

When the offerer generates an SDP offer, in order to negotiate the establishment of a media plane control channel, the offerer shall include a media description ("m=" line) associated with the media plane control channel. In addition, the offerer may associate an SDP fmtp attribute with the media description.

NOTE: "Initial offer" refers to the offer when the media plane control channel is initially negotiated. It might, or might not, be the initial offer within the session.

14.2.2 "mc_queueing" fmtp attribute

The MCPTT client shall include the "mc_queueing" fmtp attribute in SDP offers when queueing of floor request is supported.

The controlling MCPTT function shall include the "mc_queueing" fmtp attribute in SDP offers when queueing of floor request is supported.

The non-controlling MCPTT function shall include the "mc_queueing" fmtp attribute in SDP offers if the controlling MCPTT included the "mc_queueing" fmtp attribute in the SDP offer.

14.2.3 "mc_priority" fmtp attribute

The MCPTT client shall include the "mc_priority" fmtp attribute when a floor priority different than the default floor priority is required. The MCPTT client should base floor priority on the configured value in 3GPP TS 24.384 [13].

When inviting an MCPTT client or an MCPTT group to a pre-arranged group call, the controlling MCPTT function and the non-controlling MCPTT function shall include in the "mc_priority" fmtp attribute with the value of the <user-priority> element in the <entry> element specified in 3GPP TS 24.381 [12].

14.2.4 "mc_granted" fmtp attribute

The MCPTT client shall include the "mc_granted" fmtp attribute in the SDP offer of an initial SIP INVITE request when it is acceptable for the MCPTT client to receive a granted indication in the SIP 200 (OK) response to an initial INVITE request.

14.2.5 "mc_implicit_request" fmtp attribute

The MCPTT client shall include the "mc_implicit_request" fmtp attribute when a SIP request shall be interpreted as an implicit floor request. If not explicitly stated in procedures in the present document or in procedures in 3GPP TS 24.379 [2] that the "mc_implicit_request" fmtp attribute shall be included, the decision to include the "mc_implicit_request" fmtp attribute or not, is an implementation option.

14.3 Generating the SDP answer

14.3.1 General

When the answerer receives an SDP offer, which contains a media description for a media plane control channel, the answerer shall include a media description associated with the media plane control channel in the answer. In addition, the answerer may associate an SDP fmtp attribute with the media description. The SDP fmtp attribute shall not include parameters that were not present in the associated SDP offer.

14.3.2 "mc_queueing" fmtp attribute

The MCPTT client shall include the "mc_queueing" fmtp attribute in SDP answers when queueing of floor request is supported.

The controlling MCPTT function shall include the "mc_queueing" fmtp attribute in SDP answers when queueing of floor request is supported and the "mc_queueing" fmtp attribute was included in the SDP offer.

The non-controlling MCPTT function shall include the "mc_queueing" fmtp attribute in SDP answers if the controlling MCPTT function included the "mc_queueing" fmtp attribute in the SDP offer.

NOTE: For MCPTT clients connected to the non-controlling MCPTT function, the determination of if queueing is supported or not is determine case by case using the Track Info field for each individual floor participant.

14.3.3 "mc_priority" fmtp attribute

If the "mc_priority" fmtp attribute is included in an SDP offer, the controlling MCPTT function shall include the "mc_priority" fmtp attribute in the SDP answer using the value of the <user-priority> element in the <entry> element of the MCPTT group document specified in 3GPP TS 24.381 [12] as follows:

1. if the floor priority is too high, the controlling MCPTT function shall include the value of the <user-priority> element in the "mc_priority" fmtp attribute in the SDP answer; and

2. if the requested floor priority is the same or lower, the controlling MCPTT function shall include the received value in the "mc_priority" fmtp attribute in the SDP answer.

If the "mc_priority" fmtp attribute is included in an SDP offer, the MCPTT client and the non-controlling MCPTT function shall return the value included in the SDP offer in the SDP answer.

14.3.4 "mc_granted" fmtp attribute

If the mc_granted" fmtp attribute is included in an SDP offer, the controlling MCPTT function may use the SIP 200 (OK) response to indicated that the implicit floor request is granted. If the controlling MCPTT function grants the implicit request and decide to use the SIPP 200 (OK) response to grant the implicit request, the controlling MCPTT function shall include the "mc_granted" fmtp attribute in the SDP answer.

14.3.5 "mc_implicit_request" fmtp attribute

If the "mc_implicit_request" fmtp attribute is included in an SDP offer, the MCPTT server shall accept the initial INVITE request to be an implicit request for floor unless the MCPTT client is joining a chat group call or an ongoing pre-arranged call and include the "mc_implicit_request" fmtp attribute in responses to the SIP request.

14.4 Offerer processing of the SDP answer

When the offerer receives an SDP answer, if an SDP fmtp attribute is associated with the media description associated with the media plane control channel, and if the attribute contains attribute parameters that were not present in the associated offer, the offerer shall discard those attribute parameters.

14.5 Modifying the media plane control channel

When an offerer generates a subsequent SDP offer, the offerer follows the rules for generating an initial offer, as described in subclause 14.2, with the exception that the offerer shall not include the 'mc_granted' SDP fmtp attribute parameter in a subsequent offer. No semantics has been defined for the 'mc_granted' attribute parameter in a subsequent offer.

For the 'mc_implicit_request' semantic is only defined for a subsequent SDP offer when upgrading from normal to an emergency call using an SIP re-INVITE request as specified in 3GPP TS 24.379 [2].

14.6 The use of SDP offer / answer procedures in off-network mode

14.6.1 General

The MCPTT client can negotiate the capabilities used in a private call using PRIVATE CALL SETUP REQUEST message and PRIVATE CALL ACCEPT message as specified in 3GPP TS 24.379 [2]. The PRIVATE CALL SETUP REQUEST message contains the SDP offer and the PRIVATE CALL ACCEPT message contains the SDP answer.

When initiating a group call or a broadcast group call using the GROUP CALL ANNOUNCEMENT message or GROUP CALL BROADCAST message as specified in 3GPP TS 24.379 [2] the capabilities to be used during the call cannot be negotiated.

14.6.2 fmtp attribute "mc_queueing"

When initiating a private call and if the MCPTT client supports queueing of floor requests, the MCPTT client shall include the fmtp attribute "mc_queueing" in the SDP offer.

When an MCPTT client accepting the invitation to the private call receives an SDP offer containing the fmtp attribute "mc_queueing" and if the MCPTT client supports queueing of floor requests, the MCPTT client shall include the fmtp attribute "mc_queueing" in the SDP answer.

When initiating a group call and if queueing of floor requests is supported, the MCPTT client shall include the fmtp attribute "mc_queueing" in the SDP offer.

NOTE: Participants in a group call where queueing is used acknowledge the support of queueing in the Floor Indicator field in the Floor Request message.

Annex A (informative): Signalling flows

A.1 Scope of signalling flows

This annex gives examples of signalling flows for media plane such as:

1. On-network floor control signalling flows;
2. Off-network floor control signalling flows;
2. Pre-established session control signalling; and
3. MBMS subchannel control signalling flows.

These signalling flows provide detailed signalling flows, which expand on the overview information flows provided in 3GPP TS 23.179 [5].

A.2 Introduction

A.2.1 General

The signalling flows provided in this annex follow the methodology developed in this specification.

A.2.2 Key required to interpret signalling flows

In order to differentiate between messages for floor control, pre-established call session control, MBMS subchannel control messages, SIP messages and RTP media packets, the notation in figure A.2.2-1 is used.

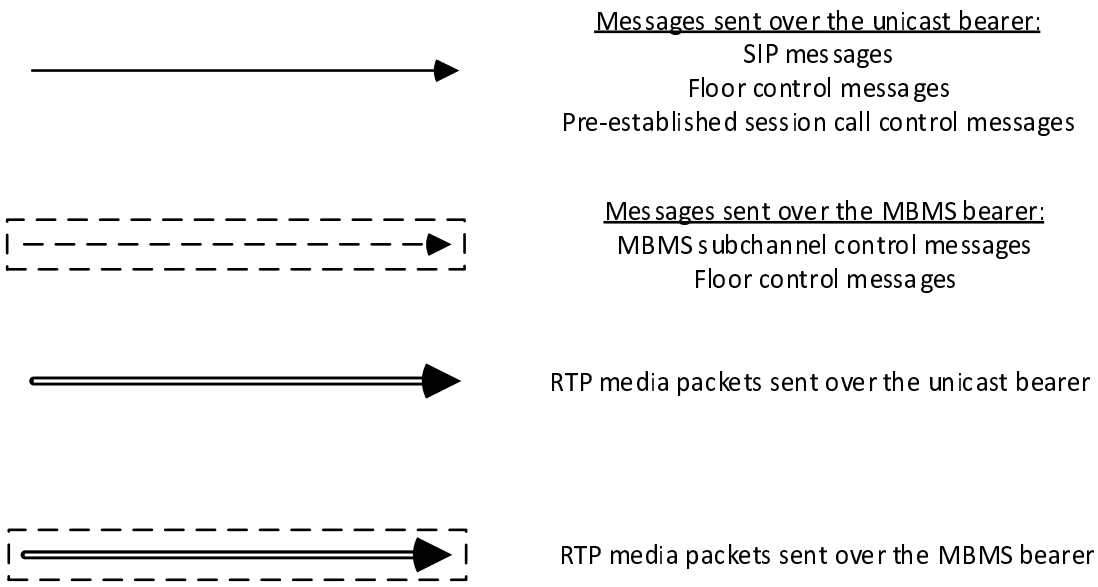


Figure A.2.2-1: Signalling flow notation

A.3 On-network floor control signalling flows

A.3.1 General

The following subclauses contain the following on-network example flows:

1. Floor request when the floor is idle in subclause A.3.2;
2. Floor request when floor is taken and queueing is not applied in subclause A.3.3;
3. Floor request when floor is taken and queueing is applied in subclause A.3.4; and
4. Pre-emptive floor request when floor is taken in subclause A.3.5.

A.3.2 Floor request when the floor is idle

Figure A.3.2-1 illustrates a case a user request floor and is granted the floor during an ongoing MCPTT call.

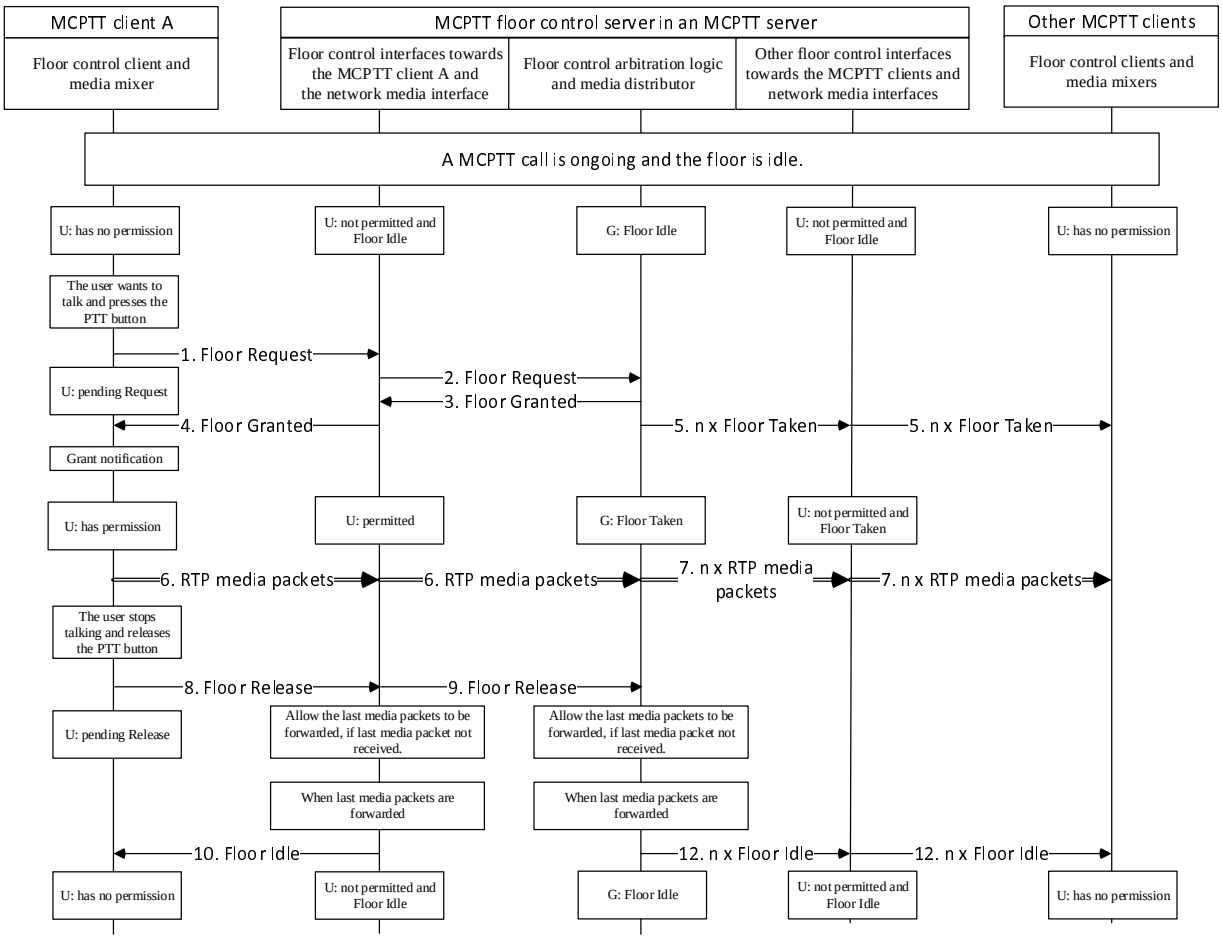


Figure A.3.2-1: Floor request when the floor is idle

The user at MCPTT client A wants to talk and presses the push-to-talk button.

The steps of the flow are as follows:

1. The floor participant in the MCPTT client A sends a Floor Request message to the floor control server.

2. When the floor control interface towards the MCPTT client A receives the Floor Request message in the 'U: not permitted and Idle' state the Floor Request message is forwarded to the floor control arbitration logic.

3. When the floor control arbitration logic receives the Floor Request message in the 'G: Idle' state, the floor request is authorized. If the floor request is authorized, the floor control arbitration logic sends the Floor Grant message to the floor control interface towards the MCPTT client A and changes the state to 'G: Floor Taken'.

4. The floor control interface towards the MCPTT client A forwards the Floor Grant message to the floor participant in the associated MCPTT client and changes the state to 'U: permitted'.

5. The floor control arbitration logic sends a Floor Taken message to all other participants in the MCPTT call via the other floor control interfaces towards the MCPTT clients.

   When the Floor Taken message is received by the other floor control interfaces towards the MCPTT clients the Floor Taken message is forwarded to the floor participant in the associated MCPTT client and the state is changed to the 'U: not permitted and Taken' state.

6. On receipt of the Floor Grant message the floor participant in the associated MCPTT client provides a grant notification to the MCPTT user, changes the state to 'U: has permission' and the MCPTT client A starts to forward RTP media packets towards the MCPTT server.

7. The media distributor distributes the RTP media packets to all other MCPTT clients in the MCPTT call.

8. When the user at MCPTT client A stops talking and releases the push-to-talk button the floor participant in the MCPTT client A sends a Floor Release message to the floor control server and enter the 'U: pending Release' state.

9. When the floor control interface towards the MCPTT client A receives the Floor Release message the Floor Release message is forwarded to the floor control arbitration logic. The floor control interface towards the MCPTT client A allows the last RTP media packets to be forwarded to the media distributor in the MCPTT server.

10. When the last RTP media packet is forwarded to the media distributor in the MCPTT server the floor control interface towards the MCPTT client A sends the Floor Idle message to the floor participant in associated MCPTT client A and changes the state to 'U: not permitted and Floor Idle'.

11. When the floor control arbitration logic receives the Floor Release message the last RTP media packets are allowed to be forwarded.

12. When the last RTP media packets are distributed by the media distributor the floor control arbitration logic sends a Floor Idle message to all participants in the MCPTT call with the exception of the MCPTT client that was permitted to send media and changes state to 'G: Floor Idle'. The Floor Idle message is forwarded by the other floor control interface towards MCPTT clients. The state in the other floor control interface towards MCPTT clients is changed to 'U: not permitted and Floor Idle'.

A.3.3 Floor request when floor is taken and queueing is not applied

Figure A.3.3-1 illustrates a case when a user request floor when the floor is taken and queueing is not applied in the MCPTT call.

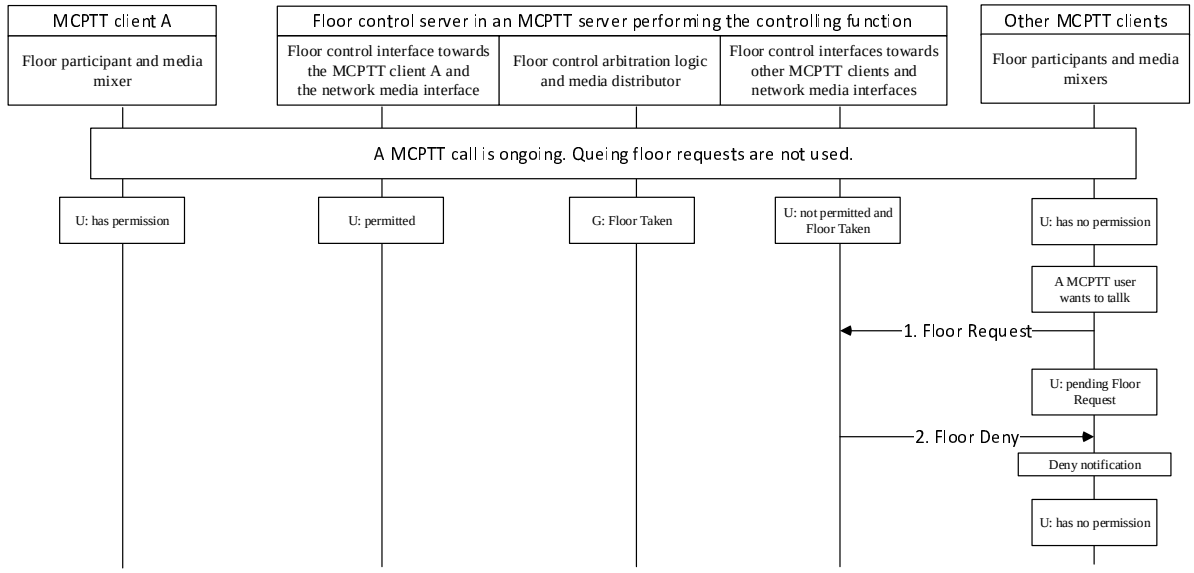


Figure A.3.3-1: Floor request when floor is taken when queueing is not applied

One of the users in the MCPTT call wants to speak and presses the push-to-talk when the floor is already taken by the MCPTT client A.

1. The floor participant in one of the other MCPTT clients sends the Floor Request message towards the floor control server. The Floor participant enters the 'U: pending Floor Request' state.

2. When one of the other floor control interface towards MCPTT clients receives a Floor Request message in the 'U: not permitted and Taken' state and if:

   - the floor request does not include higher priority than the current user permitted to talk requested; and

- when queuieng of floor requests are not negotiated;

then the other floor control interface towards MCPTT clients send a Floor Deny message towards the floor participant in the associated MCPTT client.

When the floor participant in the associated MCPTT client receives the Floor Deny message, the floor participant provides a deny notification to the user. The Floor participant enters the 'U: has no permission' state.

A.3.4 Floor request when floor is taken and queueing is applied

Figure A.3.4-1 illustrates a case when a user request floor when the floor is taken and queueing is applied in the MCPTT call.

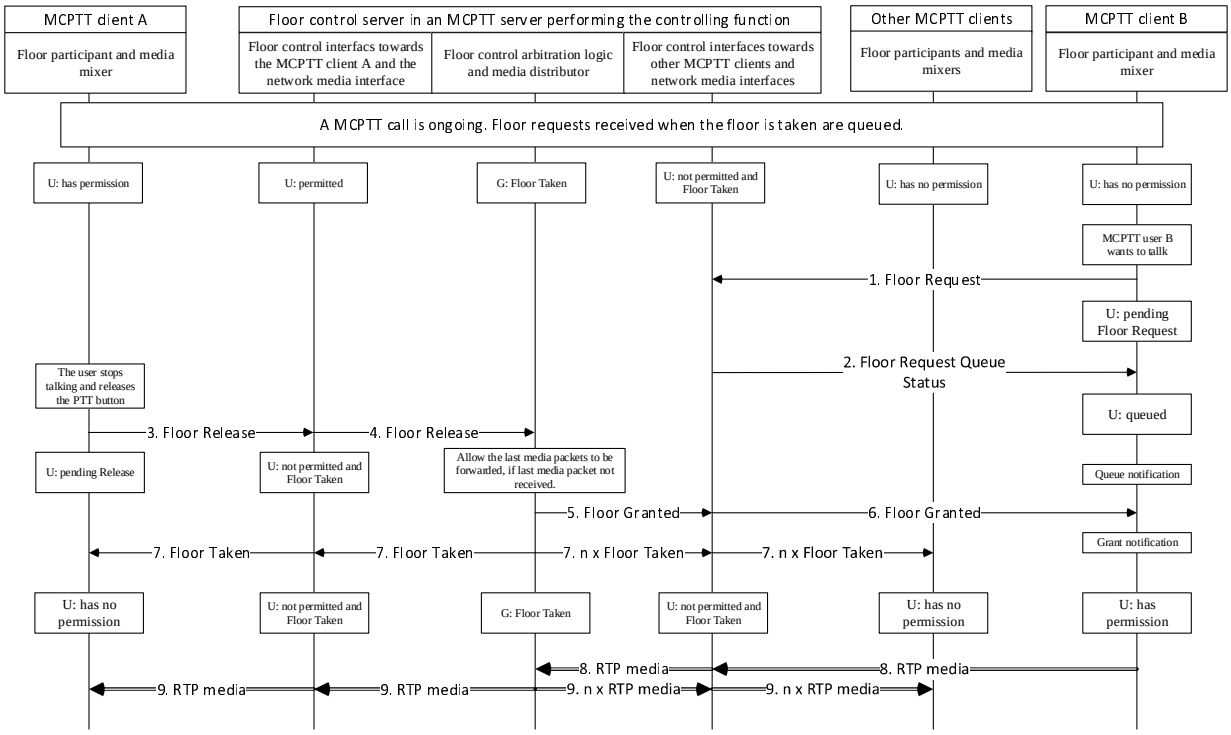


Figure A.3.4-1: Floor request when floor is taken and queueing applied

The users at MCPTT client B wants to speak and presses the push-to-talk when the floor is already taken by the MCPTT client A.

The steps of the flow is as follows:

1. The floor participant in the MCPTT client B sends the Floor Request message towards the floor control server.
2. When the floor control interface towards the MCPTT client B receives a Floor Request message in the 'U: not permitted and Taken' state and if:

   a. the floor request does not include higher priority than the user already permitted to talk requested; and

   b. when queueing of floor requests are negotiated as specified in clause 14;

   then the floor control interface towards the MCPTT client B queues the Floor Request message and sends a Floor Queue Position Info message towards the floor participant in the MCPTT client B.

   When the floor participant in MCPTT client B receives the Floor Queue Position Info message the floor participant provides a queueing indications to the user and enter the 'U: queued' state.

3. When the user at MCPTT client A stops talking and releases the push-to-talk button the floor participant in the MCPTT client A sends a Floor Release message to the floor control server and enter the 'U: pending Release' state.

4. When the floor control interface towards the MCPTT client A receives the Floor Release message the Floor Release message is forwarded to the floor control arbitration logic.

5. When the floor control arbitration logic receives the Floor Release message the last RTP media packets are allowed to be forwarded. When thast RTP media packets are distributed the floor control arbitration logic checks the floor request queue. In this example there is one floor request in the queue and a Floor Grant message is sent towards the floor participant in the MCPTT client B.

6. The floor control interface towards MCPTT client B interface forwards the message to the floor participant in MCPTT client B and changes the state to 'U: permitted'.

7. The floor control arbitration logic sends a Floor Taken message to all other participants in the MCPTT call via the other floor control interfaces towards MCPTT clients.

   When the Floor Taken message is received by the other floor control interface towards MCPTT clients Floor Taken message is forwarded to the floor participants in the associated MCPTT client. The floor participant in the MCPTT client A changes the state to the'U: not permitted and Taken' state.

8. On receipt of the Floor Grant message the floor participant in MCPTT client B provides a grant notification to the MCPTT user, changes the state to 'U: has permission' and the MCPTT client A starts to forward RTP media packets towards the MCPTT server.

9. The media distributor distributes the RTP media packets to all other MCPTT clients in the MCPTT call.

A.3.5 Pre-emptive floor request when floor is taken

Figure A.3.5-1 shows the message flow when a user with pre-emptive priority request floor when the floor is already taken by another user.

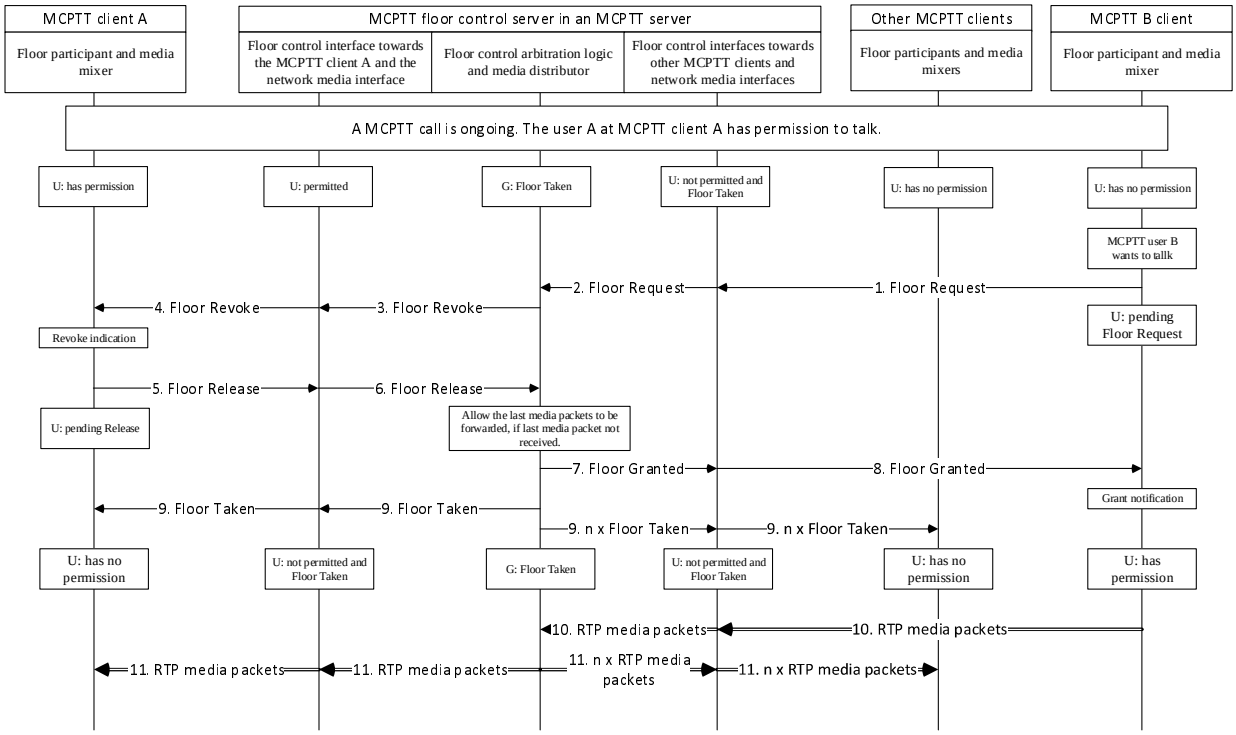


Figure A.3.5-1: Pre-emptive floor request when floor is taken

The users at MCPTT client B wants to interrupt the user at the MCPTT client presses the push-to-talk indicating a pre-emptive priority.

The steps of the flow are as follows:

1. The floor participant in the MCPTT client B sends the Floor Request message towards the floor control server. The message includes an pre-emtive priority.

2. When the floor control interface towards MCPTT client interface in the MCPTT server receives a Floor Request message in the 'U: not permitted and Taken' state and since the Floor Request message includes a higher pre-emptive priority than the user that is already permitted to send media the floor control interface towards the MCPTT client sends the Floor Request message to the floor control server arbitration logic.

3. When the floor control server arbitration logic receives the Floor Request message with the high pre-emtive priority, the floor control server arbitration logic revokes the current talker's permission to talk by sending a Floor Revoke message to the floor control interface towards the MCPTT client A.

4. The floor control interface towards MCPTT client A forwards the Floor Revoke message to the floor participant in MCPTT A.

5. When the floor participant in the MCPTT client A receives the Floor Revoke message, the floor participant provides a floor revoke indication to the MCPTT user, sends a Floor Release message and changes the state to 'U: pending Release'.

6. When the floor control interface towards the MCPTT client A receives the Floor Release message, the Floor Release message is forwarded to the floor control server arbitration logic.

7. When the floor control arbitration logic receives the Floor Release message the last RTP media packets are allowed to be received. When thast RTP media packets are distributed the floor control arbitration logic sends a Floor Grant message towards the floor control interface towards the MCPTT client B.

8. The floor control interface towards MCPTT client receives the Floor Grant message the Floor Grant message is sent to the floor participant in MCPTT client B and changes the state to 'U: permitted'.

9. The floor control arbitration logic sends a Floor Taken message to all other participants in the MCPTT call via the other floor control interfaces towards the MCPTT clients.

   When the Floor Taken message is received by the other floor control interfaces to MCPTT clients the Floor Taken message is forwarded to the floor participant in the associated MCPTT client. The floor participant in the MCPTT client A changes the state to the'U: not permitted and Taken' state.

10. On receipt of the Floor Grant message the floor participant in MCPTT client B provides a grant notification to the MCPTT user, changes the state to 'U: has permission' and the MCPTT client A starts to forward RTP media packets towards the MCPTT server.

11. The media distributor in the MCPTT server distributes the RTP media packets to all other MCPTT clients in the MCPTT call.

A.4 Off-network floor control signalling flows

A.4.1 General

This subclause provides the following message flow examples:

1. floor request when the floor is idle is shown in subclause A.4.2.1;

2. floor request when floor is taken and queueing of floor requests is not applied is shown in subclause A.4.2.2;

3. floor request when floor is taken and queueing of floor requests is applied is shown in subclause A.4.2.3; and

4. pre-emptive floor request when floor is taken is shown in subclause A.4.2.4.

A.4.2 Off-network floor control during an MCPTT group call

A.4.2.1 Floor request when the floor is idle

Figure A.4.2.1-1 illustrates a user"s floor request when the floor is idle i.e. there is no floor arbitrator.

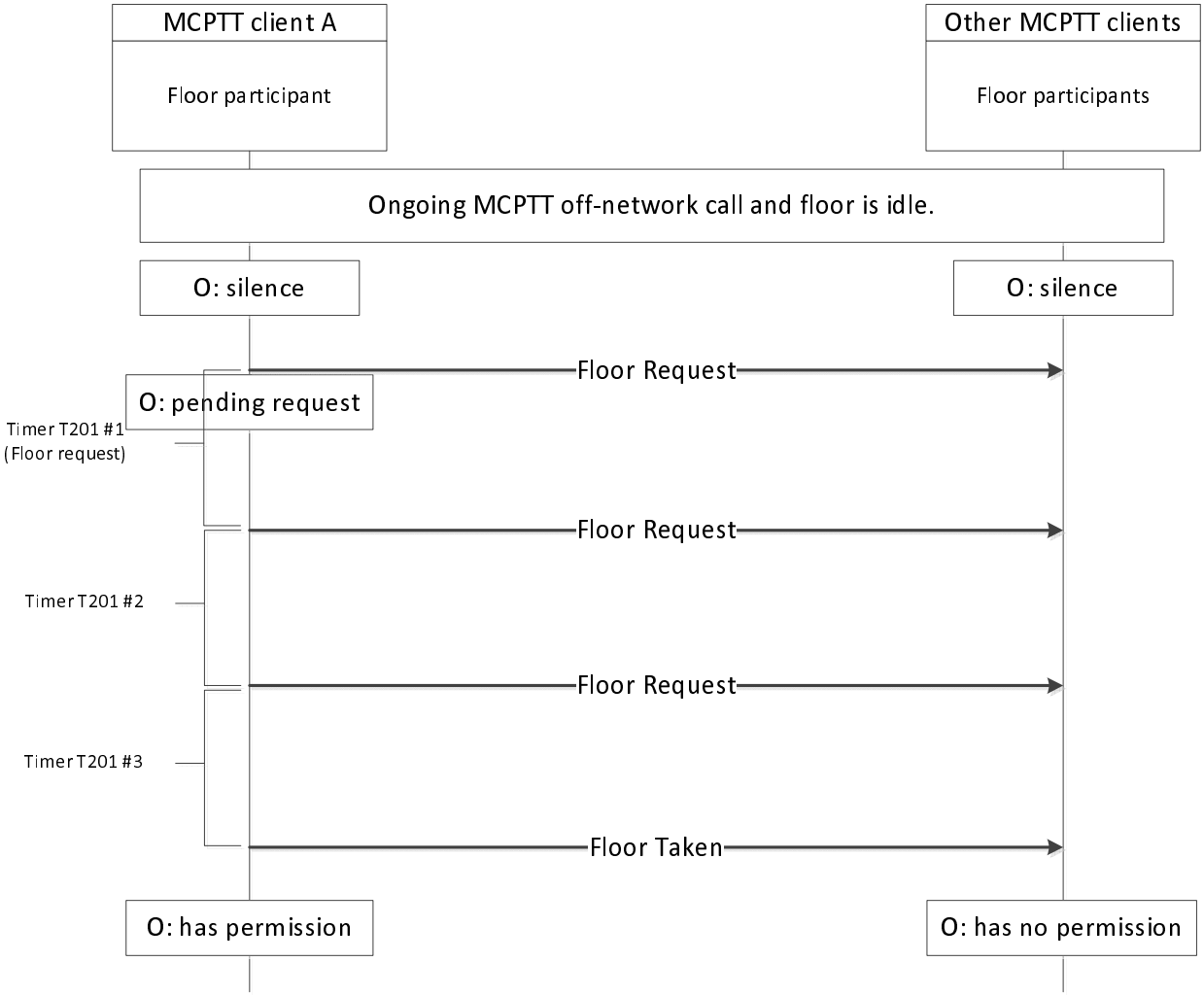


Figure A.4.2.1-1: Floor request when the floor is idle

The user at MCPTT client A wants to talk and presses the push-to-talk button.

The steps of the flow are as follows:

1. The floor participant in the MCPTT client A sends a Floor Request message towards other MCPTT clients and starts timer T201 (Floor Request). MCPTT client A moves to "O: pending request" state.
2. On expiry of T201 (Floor Request) MCPTT client A re-sends the Floor Request message and restarts timer T201 (Floor Request). This step has to be repeated for a pre-configured number of times (3 times in the example figure) before assuming that the floor is idle.
3. On the expiry of the last itereation of timer T201 (Floor Request), MCPTT client A sends a Floor Taken message towards other MCPTT client and assumes the role of floor arbitrator. MCPTT client A moves to "O: has permission state".
4. On receiving Floor Taken message, all other MCPTT clients move to "O: has no permission state".

A.4.2.2 Floor request when floor is taken and queueing of floor requests is not applied

Figure A.4.2.2-1 illustrates a user's floor request when the floor is taken and queueing is not applied in the MCPTT call.

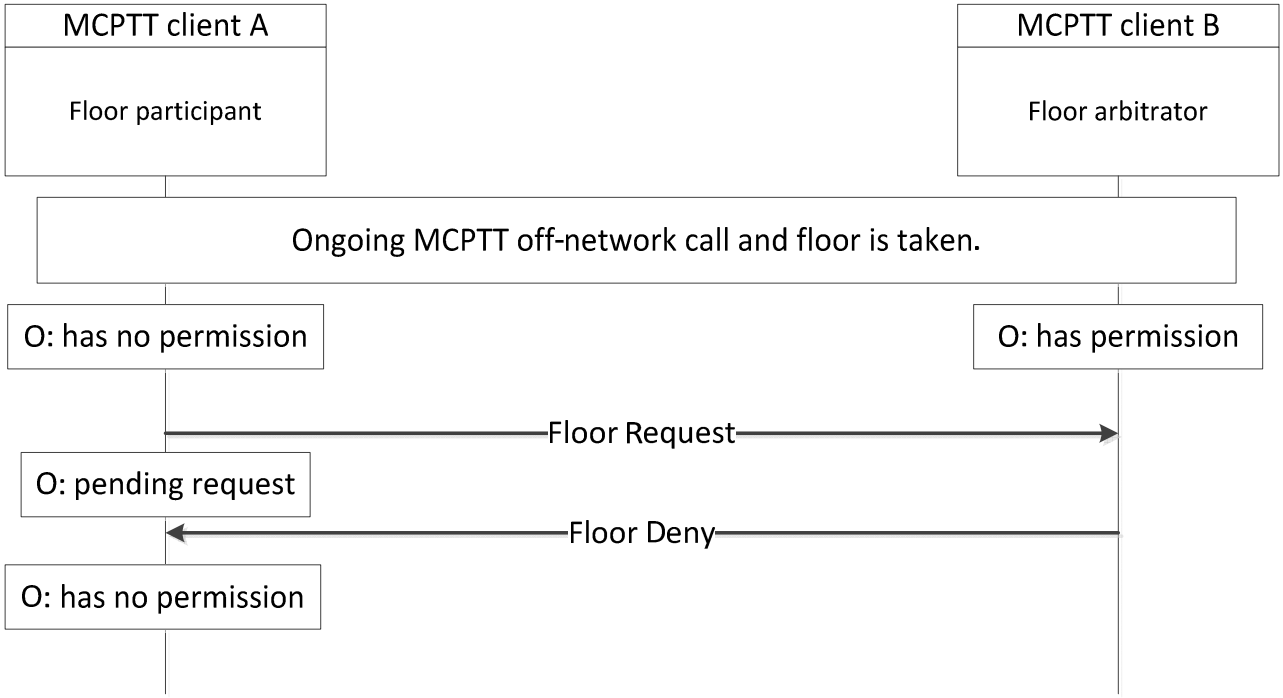


Figure A.4.2.2-1: Floor request when floor is taken when queueing is not applied

One of the users in the MCPTT call wants to speak and presses the push-to-talk when the floor is already taken by the MCPTT client B and queueing is not applied.

1. The floor participant in MCPTT client A sends the Floor Request message towards other MCPTT clients. The Floor participant enters the 'O: pending request' state.
2. On receiving Floor Request message, MCPTT client B sends a Floor Deny message with MCPTT client A"s ID towards all MCPTT clients.
3. On receiving Floor Deny message, MCPTT client A moves back to "O:has no permission" state.

A.4.2.3 Floor request when floor is taken and queueing is applied

Figure A.4.2.3-1 illustrates a user"s floor request when the floor is taken and queueing is applied in the MCPTT call.

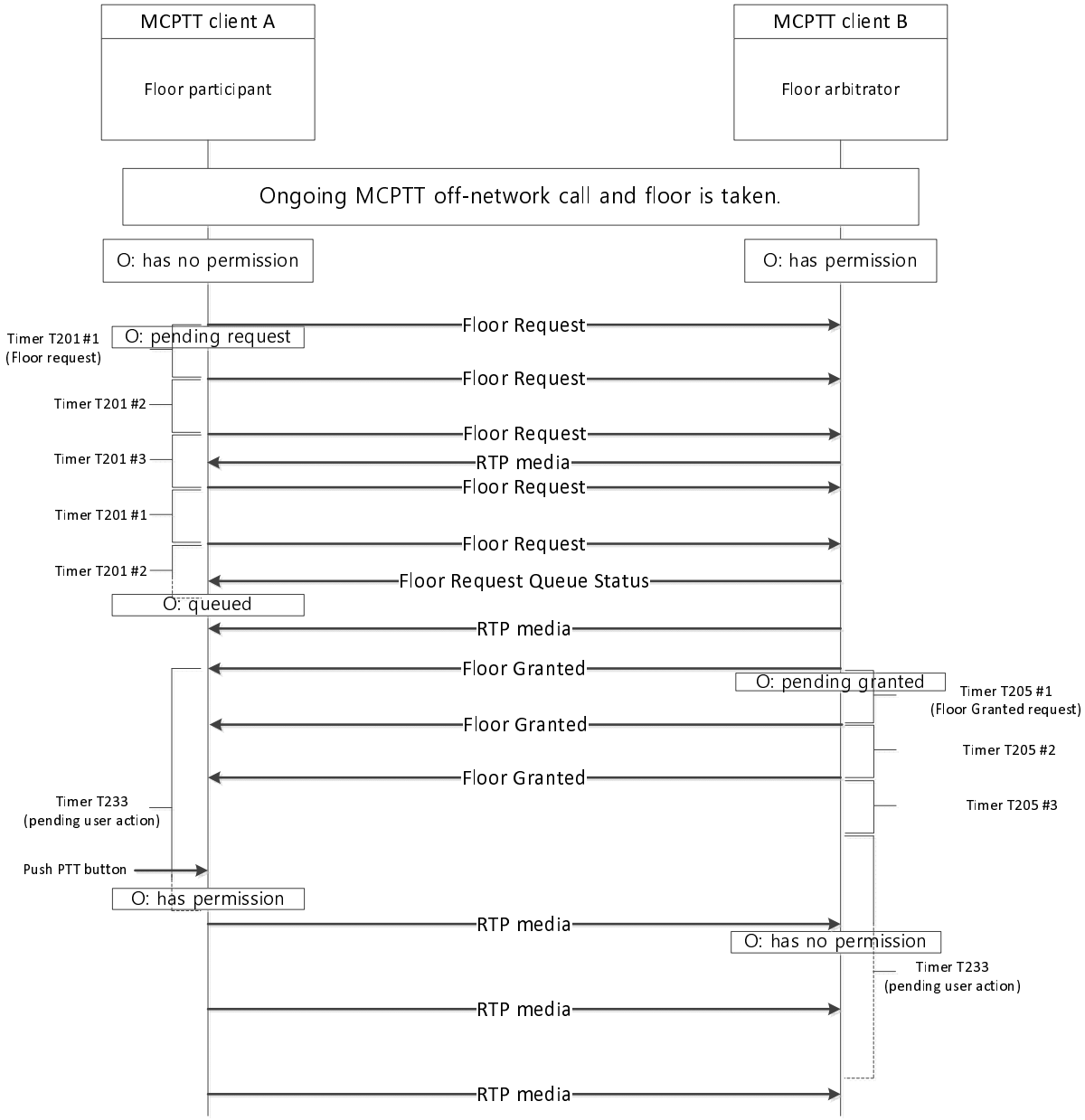


Figure A.4.2.3-1: Floor request when floor is taken and queueing applied

The users at MCPTT client A wants to speak and presses the PTT button when the floor is already taken by the MCPTT client B.

The steps of the flow are as follows:

1. The floor participant in the MCPTT client A sends the Floor Request message towards other MCPTT clients. MCPTT client A moves to "O: pending request" state and starts timer T201 (Floor Request).

2. On expiry of timer T201 (Floor Request) MCPTT client A re-sends the Floor Request message and restarts timer T201 (Floor Request). This step has to be repeated for a pre-configured number of times before assuming that the floor is idle.

3. Receiving RTP media indicates that the floor is taken and an arbitrator is present. Sending multiple requests till a reply to the request is received helps reduce conflicts. Therefore, the counter associated to T201 (Floor Request) is reset everytime RTP media is received.

4. On receiving Floor Queue Position Info message from the floor arbitrator, MCPTT client A stops timer T201 (Floor Request) and moves to "O: queued" state. Any RTP media received in this state is rendered.

5. When the user at MCPTT client B indicates to terminate RTP media transmission, MCPTT client B sends Floor Granted message to the next (MCPTT client A) in queue. MCPTT client B start timer T205 (Floor Granted request) and moves to "O: pending grant" state.

6. On receiving Floor Granted message, MCPTT client A starts timer T233 (pending user action) and waits for user to indicate start of RTP media transmission.

7. On expiry of timer T205 (Floor Granted) MCPTT client B re-sends the Floor Granted message and restarts timer T205 (Floor Granted). This step has to be repeated for a pre-configured number of times while no media is received from MCPTT client A.

8. Upon expiry of timer T205 (Floor Granted) for a preconfigured number of times, MCPTT client B starts timer T233 (pending user action), waiting for RTP media from MCPTT client A.

9. MCPTT client A stops timer T233 (pending user action) upon user action. MCPTT client A moves to "O: has permission" state and starts transmission of RTP media as floor arbitrator.

10. On receiveing RTP media from MCPTT client A, MCPTT client B stops timer T233 (pending user action) and moves to "O: has no permission" state.

A.4.2.4 Pre-emptive floor request when floor is taken

Figure A.4.2.4-1 shows the message flow when a user requests floor with a pre-emptive priority when the floor is already taken.

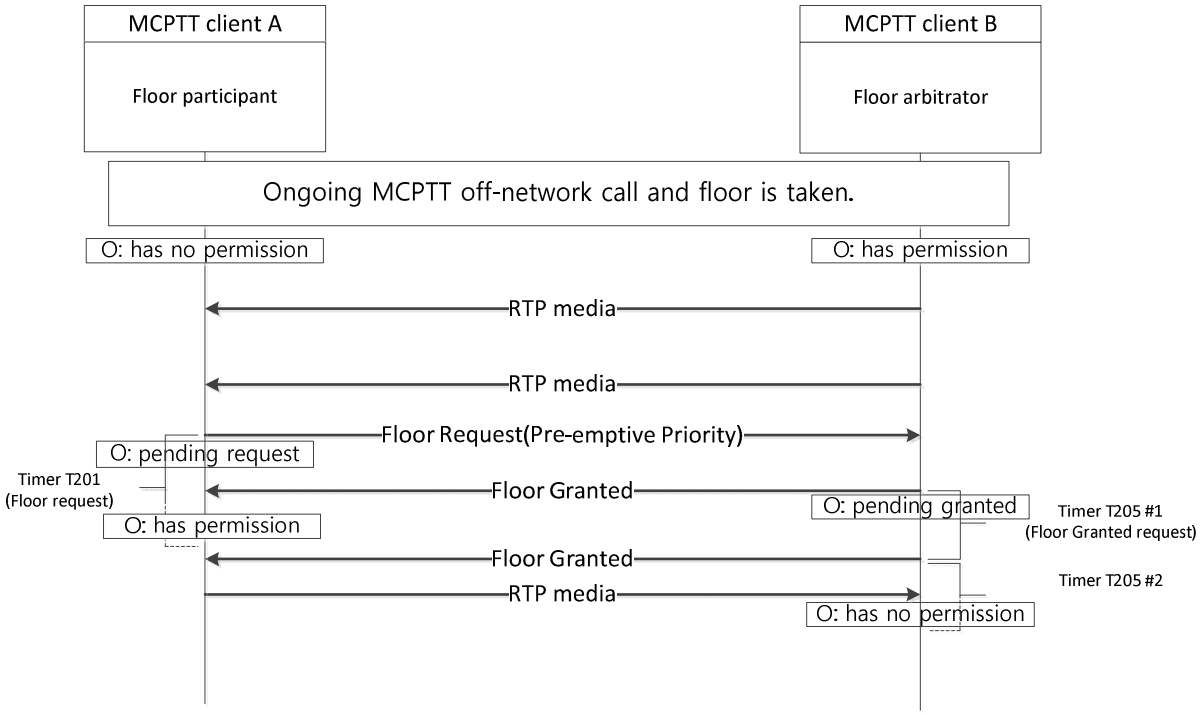


Figure A.4.2.4-1: Preemptive Floor request

The user at MCPTT client A, with higer priority than the current floor arbitrator, wants to speak and presses the push-to-talk when the floor is taken by the MCPTT client B.

The steps of the flow is as follows:

1. The floor participant in the MCPTT client A sends the preemptive Floor Request message towards other MCPTT clients and starts timer T201 (Floor Request). MCPTT client A moves to "O: pending request" state.

2. Upon receiving a higer priority floor request, MCPTT client B sends Floor Granted message and start timer T205 (Floor Granted request) . Any RTP media transmission is stoped and MCPTT client B moves to "O: pending grant" state. User at MCPTT client B can be notified of the preemption and any RTP media transmission is stooped.

3. On expiry of timer T205 (Floor Granted) the MCPTT client B re-sends the Floor Granted message and restarts timer T205 (Floor Granted). This step has to be repeated for a pre-configured number of times, if no RTP media from MCPTT client A.

4. MCPTT client A moves to "O: has permission" state and asumes the role of floor arbitrator upon receiving Floor Granted message.

5. On receiveing RTP media from MCPTT client A, MCPTT client B stops timer T205 (Floor Granted) and moves to "O: has no permission" state.

A.5 Pre-established session signalling flows

A.5.1 General

In the following subclauses signalling flows are presented for sample procedures related to the call setup and the call release when pre-established session is used.

The behaviour of an originating and terminating client is specified in subclause 9.2. The behaviour of the participating MCPTT function is specified in subclause 9.3

The behaviour of the controlling MCPTT function is specified in 3GPP TS 24.379 [2]

Only the names of the messages are indicated on the signal flow arrows. The information elements of each message can be found in subclause 9.2 and subclause 9.3 for media plane control messages and in 3GPP TS 24.379 [2] for SIP messages.

The signalling flow diagrams also indicate the state of the MCPTT client and the participating MCPTT function in the state machines specified in subclause 9.2 and subclause 9.3 respectively.

When the call initialization is accepted additional floor control dialogue is also indicated in the signalling flow.

The following signalling flows are provided:

1. call initialization at the originating side when the initialization is accepted (subclause A.5.2.1);

2. call initialization at the originating side when the initialization is rejected (subclause A.5.2.2);

3. call initialization at thetermination side when call is accepted (subclause A.5.2.3); and

4. call release (subclause A.5.3).

A.5.2 Call Initialization

A.5.2.1 Originating Side when initialization accepted

Figure A.5.2.1-1 illustrates the flow of MBCP messages when the call initiation request sent by an originating MCPTT client is accepted by the controlling MCPTT function. In this diagram it is assumed that the call initiation request includes implicit floor request.

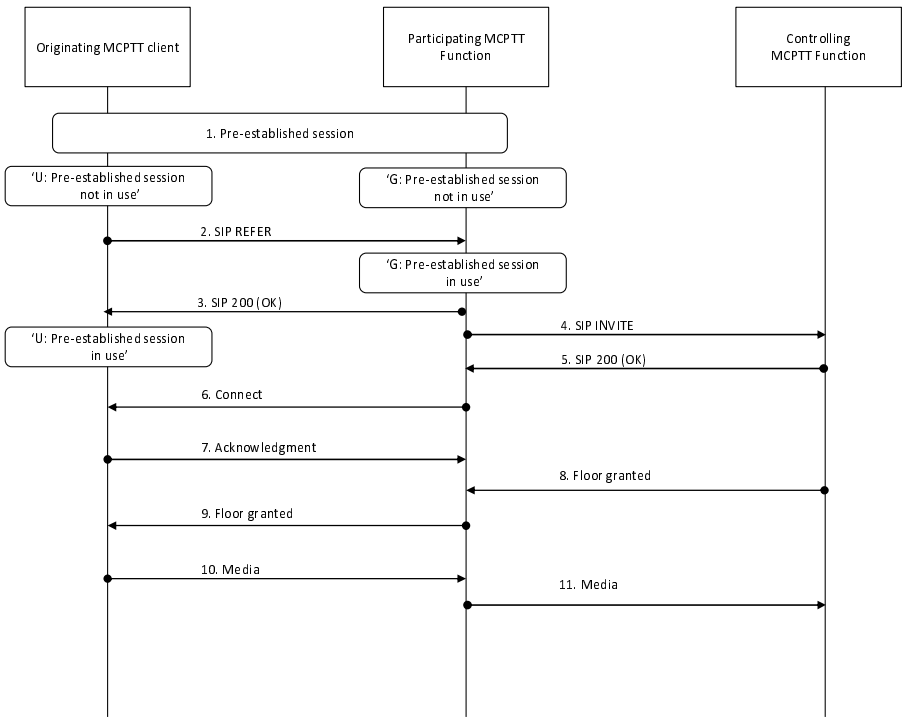


Figure A.5.2.1-1: Call initialization accepted; originating side

One of the users with a pre-established session initiates a call and the call is accepted by the controlling MCPTT function. Steps 1 to 5 are conducted using SIP messages (see 3GPP TS 24.379 [2]).

1. A pre-established session is created between the origination MCPTT user and the participating MCPTT server. The MCPTT client is in 'U:Pre-established session not in use" state and the participating MCPTT function is in 'G: Pre-establised session not in use' state.

2. The origination MCPTT client initiates a call as described in 3GPP TS 24 379 [2] by sending a SIP REFER message. The participating MCPTT function enters into 'G:Pre-established session in use' state.

3. The participating MCPTT function sends SIP 200 (OK) to the originating MCPTT client and then the originationg MCPTT client enters into 'U:Pre-established session in use' state.

4-5.The participating MCPTT function sends an SIP INVITE message to the controlling MCPTT functionand receives the SIP 200 (OK) response from the controlling MCPTT function.

6. The participating MCPTT server sends an 'Connect' message to the Originating MCPTT client.

7. The originating MCPTT client responds with an 'Acknowledgment' (accepted) message.

8. The controlling MCPTT server grants the floor to the originating MCPTT client by sending a 'Floor Granted' message

9. The participating MCPTT server forwards the 'Floor Granted' message to the originating MCPTT client

10. The originating MCPTT clients starts sending the media packets.

11. The participating MCPTT server forwards the media packets to the controlling MCPTT server

A.5.2.2 Originating Side when initialization rejected

Figure A.5.2.2-1 illustrates the flow of MBCP messages when the call initiation request by an originating MCPTT client is rejected.

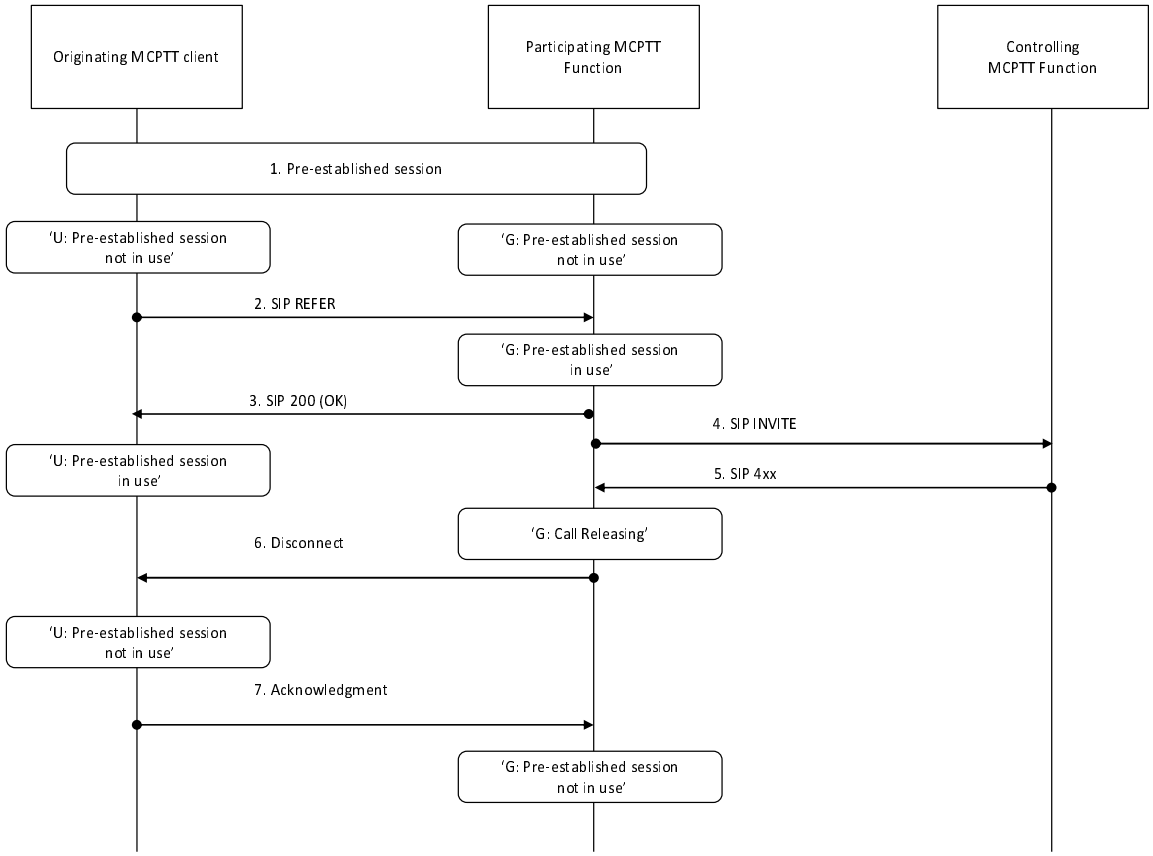


Figure A.5.2.2-1: Call initialization rejected

One of the users with a pre-established session initiates a call and the call is rejected by the controlling MCPTT function. Steps 1- 5 are conducted using SIP messages (see 3GPP TS 24.379 [2]).

1. A pre-established session is created between the origination MCPTT client and the participating MCPTT server. The MCPTT client is in 'U:Pre-established session not in use'' state and the participating MCPTT function is in 'G: Pre-establised session not in use' state.

2. The origination MCPTT client initiates a call as described in 3GPP TS 24.379 [2] by sending a SIP REFER message.Th participating MCPTT function enters into 'G:Pre-established session in use' state.

3. The participating MCPTT function sends SIP 200 (OK) to the originating MCPTT client and then the originationg MCPTT client enters into 'U:Pre-established session in use' state.

4-5.The participating MCPTT function sends an SIP INVITE message to the controlling MCPTT function and receives SIP 4xx response from the controlling MCPTT function. The participating MCPTT function enters into 'G: Call Releasing' state.

6. The participating MCPTT server sends an 'Disconnect' message to the originating MCPTT client. The originationg MCPTT client enters into 'U: Pre-established session not in use' state.

7. The originating MCPTT client responds with an 'Acknowledgment' message. Avter receiving the Acknowledgment message the participating MCPTT function enters into 'G:Pre-establisjed session not in use' state.

A.5.2.3 Termination Side when call initialization accepted

Figure A.5.2.3-1 illustrates the flow of MBCP messages when the call initiation is informed to the terminating MCPTT client. In this figure it is assumed that the call initiation request includes implicit floor request. Although the figure shows only one terminating MCPTT client, the messaging takes place with each one of the terminating MCPTT clients with a pre-established session.

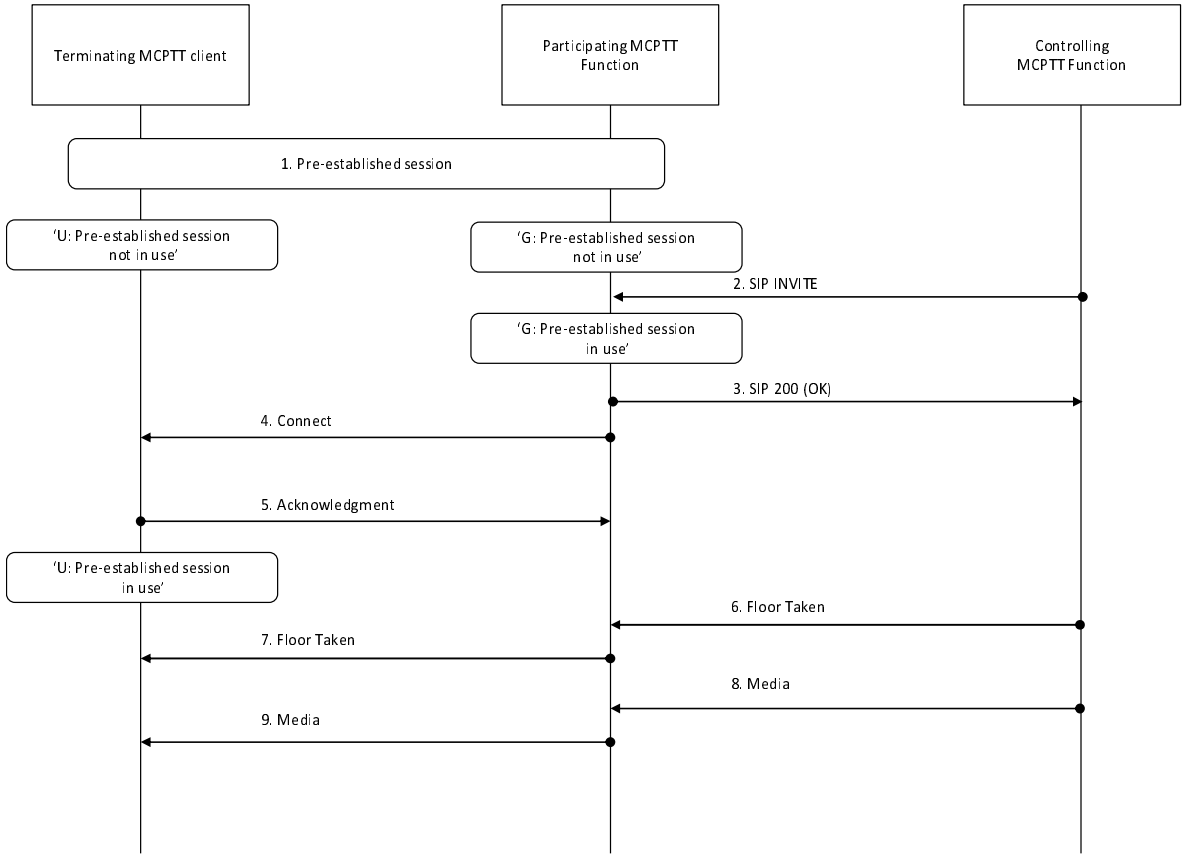


Figure A.5.2.3-1: Call initialization accepted; terminating side

When a call initiation is accepted by the controlling MCPTT function, the terminating MCPTT client(s) with pre-established session is (are) informed. Steps 1 to 3 are conducted using SIP messages (see 3GPP TS 24.379 [2]).

1. A pre-established session is created between the terminating MCPTT user and the participating MCPTT server. The MCPTT client is in 'U:Pre-established session not in use'' state and the participating MCPTT function is in 'G: Pre-establised session not in use' state.

2. The controlling MCPTT server informs the participating MCPTT server the call initiation by sending an SIP INVITE message. The participating MCPTT function enters into 'G: pre-establisjed session in use' state.

3. The participating MCPTT function send SIP 200 (OK) to the controlling MCPTT function.

4. The participating MCPTT function sends a 'Connect' message to the terminating MCPTT client.

5. The terminating MCPTT client responds with an 'Acknowledgment' message. The terminating MCPTT client enters into 'U:Pre-established session in use' state.

6. The controlling MCPTT server informs that the floor is granted to another MCPTT client by sending a 'Floor Taken' message

7. The participating MCPTT server forwards the 'Floor Taken' message to the originating MCPTT client

8. The controlling MCPTT server starts distributing the media packets sent by the talking MCPTT client.

9. The participating MCPTT server forwards the media packets to the terminating MCPTT client.

A.5.3 Call release

Figure A.5.3-1 illustrates the flow of MBCP messages when the call is released but the pre-established session used by this call is preserved.

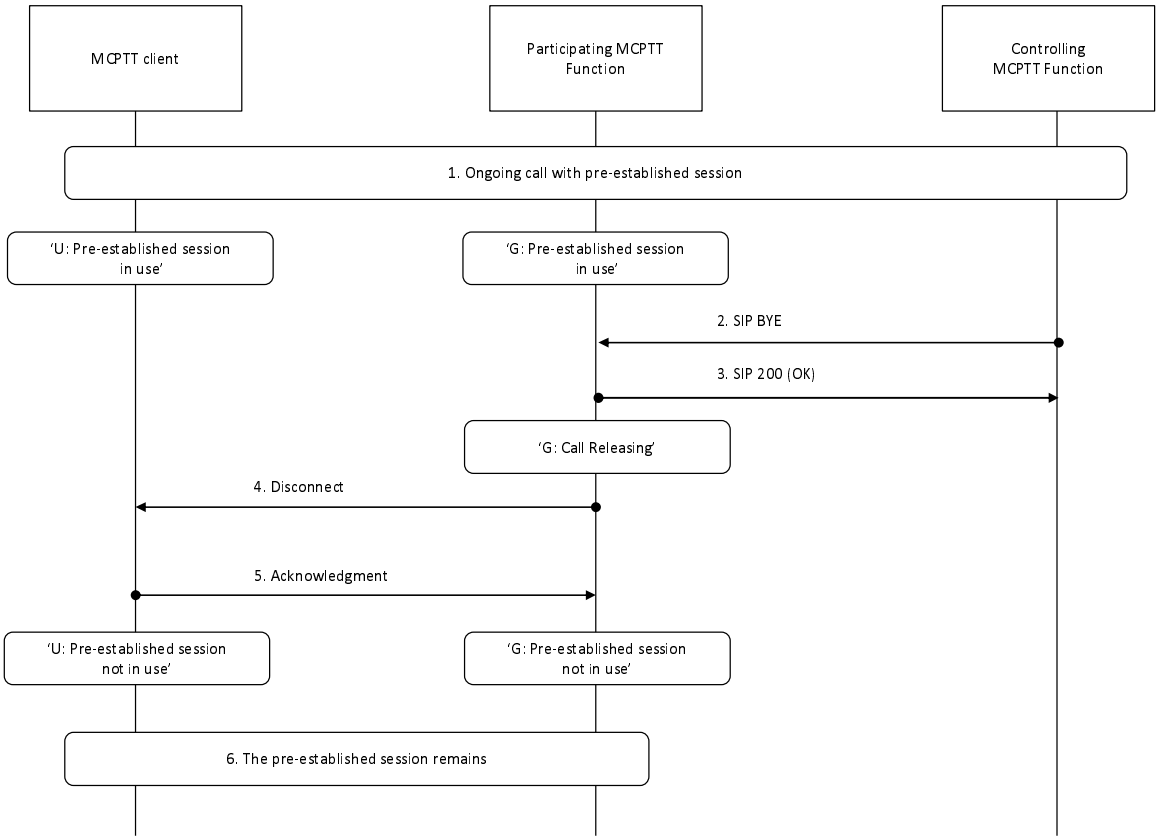


Figure A.5.3-1: Call release for a call with pre-established session

A call with a pre-established session is released by preserving the pre-established session used by this call. Steps 2 and 3 are conducted using SIP messages (see 3GPP TS 24.379 [2]).

1. A call using a pre-established session is being conducted. The MCPTT client is in 'U:Pre-established session in use' state and the participating MCPTT function is in 'G: Pre-established session in use' state.

2. The call release decission is taken by the controlling MCPTT function and informed to the participating MCPTT function as described in 3GPP TS 24.379 [2] by sending a SIP BYE message.

3. The participating MCPTT function sends an SIP ACK message to the controlling MCPTT function and enters into 'G:Call Releasing' state.

4. The participating MCPTT server sends an 'Disconnect' message to the MCPTT client of this pre-esatblished session.

5. The MCPTT client sends an Acknowledgment message to the participating MCPTT server. The MCPTT client enters to 'U: Pre-established session not in use' state and the participating MCPTT function is in 'G: Pre-established session not in use' state.

6. The pre-established session between the MCPTT client and the participating MCPTT server is preserved.

A.6 MBMS subchannel control signalling flows

A.6.1 General

The following subclauses describe examples of how an MBMS bearer is managed during group call.

The following signalling flows are provided:

- announcing MBMS subchannels (subclause A.6.2);
- initiating a conversation and requesting floor, originating side (subclause A.6.3); and
- releasing floor and ending a conversation (subclause A.6.4).

A.6.2 Announcing MBMS subchannels

This subclause contains an example message flow illustrating how the participating MCPTT function announces MBMS subchannels.

The pre-requisites to the flow are:

1. The MCPTT client participates in an ongoing group session. The group session can be either a chat group session or a pre-arranged group session.
2. There is no conversation ongoing, i.e. the floor is idle.
3. The group session has a small number of participants that depending on the availability of MBMS subchannels can use a MBMS subchannel or the unicast bearer when in an MBMS service area.

Figure A.6.2-1 shows the message flow.

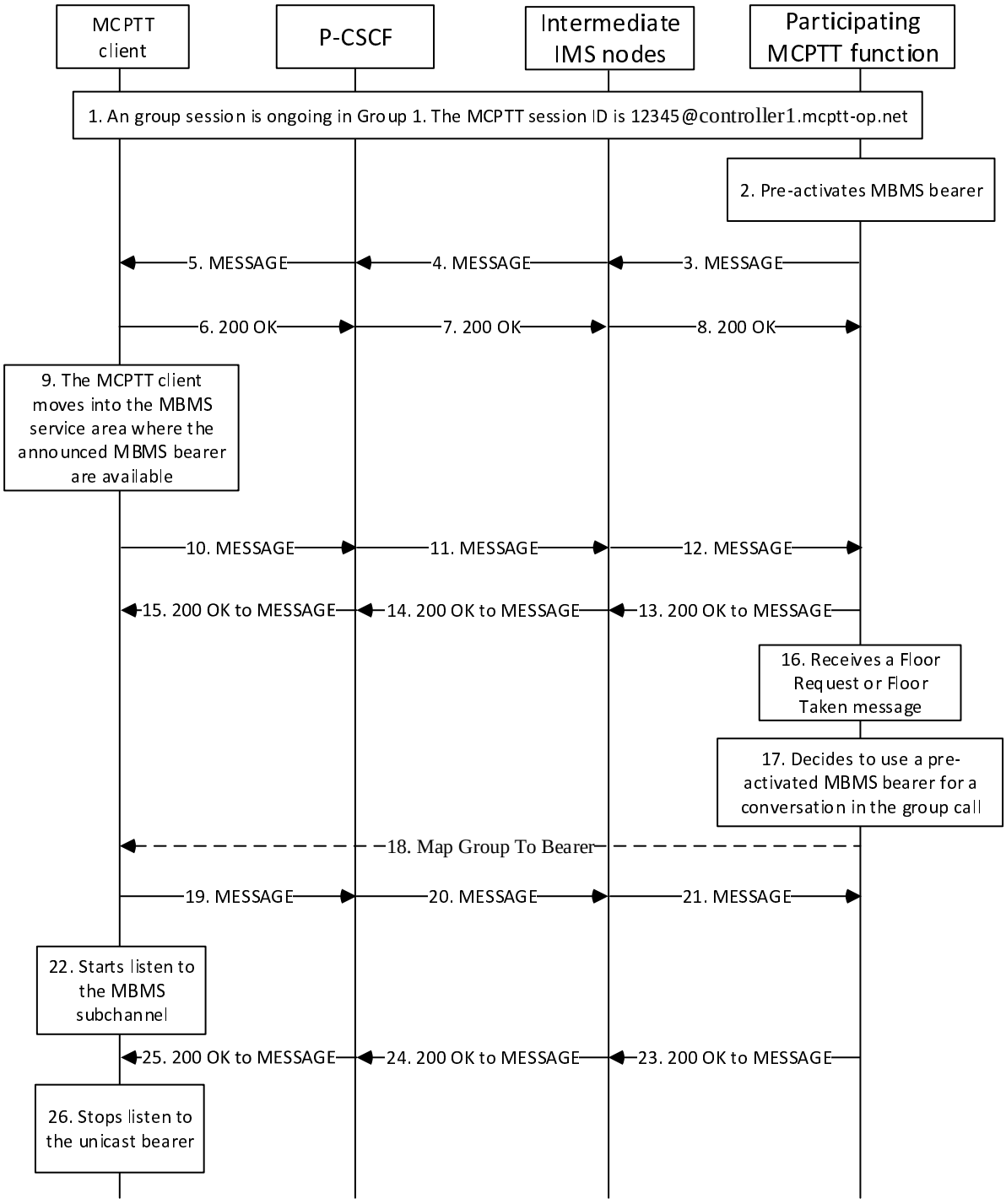


Figure A.6.2-1: Announcing MBMS subchannels

The steps of the message flow are as follows:

1. A group session is ongoing. This can be a chat group or a pre-arranged group. The MCPTT session identity for this group is 12345@controller1.mcptt-op.net.

2. The participating MCPTT function pre-activates MBMS bearers. The trigger for doing this is implementation dependent but can be a result of received location reports from MCPTT clients served by the participating MCPTT function.

3-5. The participating MCPTT functions sends a SIP MESSAGE request to a selected number of MCPTT clients. This can happen exactly after a pre-activated MBMS bearer is created or when an MCPTT client registers or an MCPTT user affiliates to a group. The SIP MESSAGE request contains:

a. the "application/vnd.3gpp.mcptt-mbms-usage-info" MIME body with:

i. a reference to media line in the "application/sdp" MIME body where the general purpose MBMS subchannels are defined in the <SDP-ref> element; and

ii. one or more <announcement> elements where each announcement contains:

A. TMGI in the <TMGI> element identifying the announcement;

B. QCI in the <QCI> element;

C. <MBFSN-area-id> element, if the information is available;

D. if multiple carrier are supported, frequency in the <frequency> element;

E. a list of MBMS service areas in the <mbms-service-areas> element;

b. an "application/sdp" MIME body with:

i. one "a=audio …" media line containing the relevant media-line attributes. Where:

A. the IP address is set the unspecified address (0.0.0.0), if IPv4, or to a domain name within the ".invalid" DNS top-level domain; and

B the port number is set to "9".

i. one "a=application …" media line to be used as the general purpose MBMS subchannel; and

ii. optionally, one or more "a=application …" media lines to be used as the MBMS subchannel for floor control.

6-8. The MCPTT client acknowledges the SIP MESSAGE request by means of the SIP 200 (OK) response.

9. The MCPTT client moves into an MBMS service area where the announced MBMS bearer is available.

10-12. The MCPTT client sends a SIP MESSAGE request containing the "application/vnd.3gpp.mcptt-mbms-usage-info" MIME body containing:

a. the <mbms-listening-status> element set to the value "listening"; and

b. the <general-purpose> set to "true".

13-15. The participating MCPTT function acknowledges the SIP MESSAGE request by means of the SIP 200 (OK) response.

16. The participating MCPTT server receives a Floor Request message from one of the served MCPTT clients or a Floor Taken message from the controlling MCPTT function indicating that a conversation is started in the group session.

17. The participating MCPTT function decides to use one of the MBMS subchannels in the pre-activated MBMS bearer for the conversation in the group session.

18. The participating MCPTT function sends the Map Group to Bearer messages over the general purpose MBMS subchannel, the Map Group To Bearer message contains:

a. the TMGI in the TMGI field;

b. the MCPTT Group Identity field in the MCPTT Group ID field;

c. the MBMS Subchannel field containing:

i. the TMGI,

ii. a reference to which media line to be used for audio; and

ii. optionally, a reference to the media line specifying the "m=application …". If this reference is absent, floor control messages are sent over the MBMS subchannel used for audio.

19-21. The MCPTT client sends a SIP MESSAGE request containing the "application/vnd.3gpp.mcptt-mbms-usage-info" MIME body containing:

a. the <mbms-listening-status> element set to the value "listening";

b. the <mcptt-session-id> set to 12345@controller1.mcptt-op.net; and

c. the TMGI;

22. The MCPTT client starts listen to the MBMS subchannel(s) indicated in the Map Group To Bearer message. Note that RTP media packets can now be received over both the MBMS subchannel and the unicast channel (the same applies for floor control messages) and the MCPTT client needs to ignore duplicated RTP media packets and floor control messages.

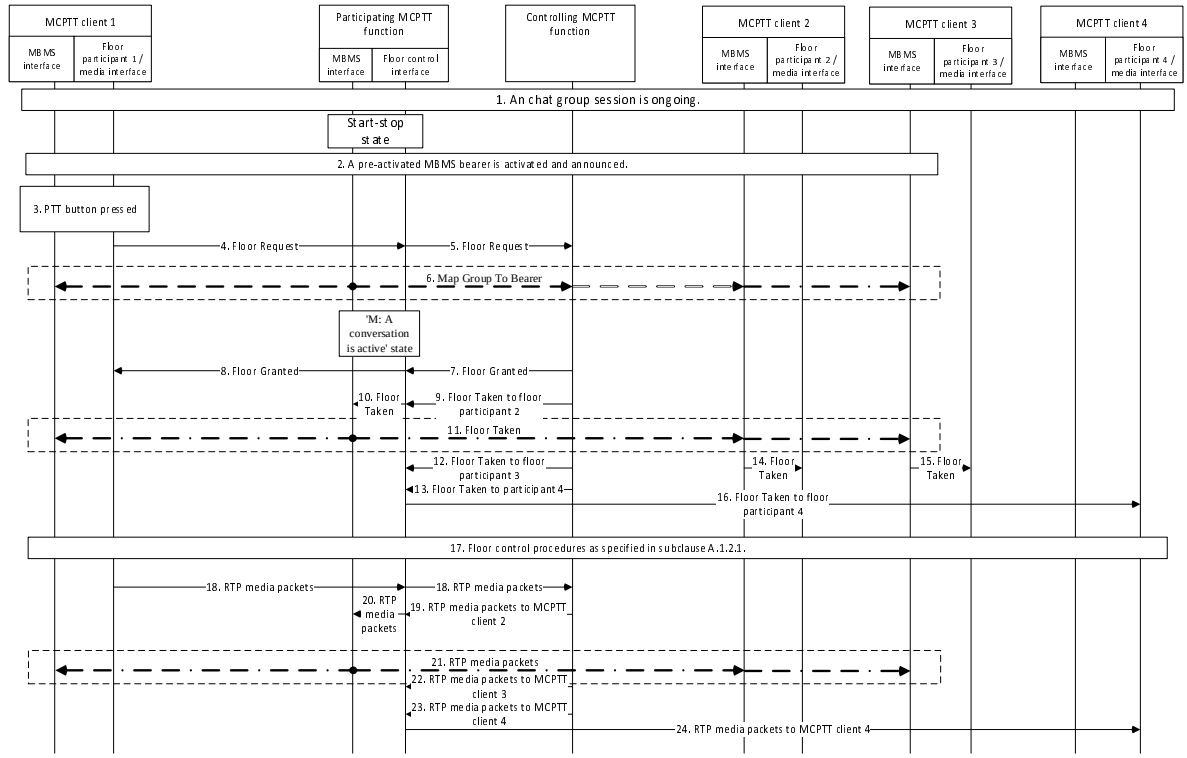
23-25. The participating MCPTT function acknowledge with a 200 (OK) response to the SIP MESSAGE request.

26. When the MCPTT client receives the SIP 200 (OK) response the MCPTT client stops listen to the unicast bearer.

A.6.3 Initiating a conversation and requesting floor, originating side

This subclause shows the signalling flow when an MCPTT client starts a conversation in an ongoing group session using a pre-activated MBMS bearer.

Figure A.6.3-1 shows the signalling flow.



NOTE: The arrows and boxes with dotted lines represent events sent over the MBMS bearer.

Figure A.6.3-1: Initiating a conversation and requesting floor

The MCPTT clients 1 to 4 participate in a group session. All MCPTT clients are served by the same participating MCPTT function. The MCPTT clients 1 to 3 are within an area where an MBMS bearer is available. The MCPTT client 4 is outside this area and can only use a unicast bearer.

A MBMS subchannel exists and associated with a general purpose media plane control channel which can be used to deliver MBMS subchannel control messages of any group in this MBMS service area.

The steps of the flow are as follows:

1. A group session is ongoing. At the moment none of the group members has the permission to send media.

2. The participating MCPTT function activates and announces an MBMS bearer as described in subclause A.6.2. The pre-activated MBMS bearer is not yet associated with a particular group with participants served by this participating MCPTT function.

3. The user at the MCPTT client 1 presses the PTT button.

4-5. The floor participant 1 sends a Floor Request as specified in subclause 6.2. The Floor Request is forwarded by the participating MCPTT function to the controlling MCPTT function.

6. When the participating MCPTT function receives the Floor Request message the participating MCPTT function determines that the previously activated and announced MBMS bearer can be used for this conversation and sends the Map Group to Bearer message over the general purpose MBMS subchannel to inform about the start of the conversation. The Map Group to Bearer message includes the TMGI, the MBMS subchannel for audio and floor control and the MCPTT group identifier in the activated MBMS bearer used for the conversation. The participating MCPTT function enters the 'M: A conversation is active' state. On receipt of the Map Group to Bearer message the MBMS interface in the MCPTT client 1, 2 and 3 associates the conversation with the TMGI, the MBMS subchannel for audio and floor control with the MCPTT group identifier in the Map Group to Bearer message.

7-8. On receipt of the Floor Request message, the floor control server function grants the floor participant 1 to send media by sending the Floor Granted message. The participating MCPTT function forwards the message to the floor participant 1 over the unicast bearer.

9-16. The floor control server sends the Floor Taken message towards all participants. The participating MCPTT functions sends one Floor Taken message over the MBMS subchannel associated with this group as declared in step 6 and discards the remaining Floor Taken messages with the exception of the Floor Taken messages towards participants not listening to the MBMS bearer, in this example, the floor participant 4.

NOTE: The participating MCPTT function uses the message-sequence-number field to determine if a Floor Taken message is already sent over the MBMS floor control bearer or not.

17. The floor control continues as described in subclause A.5.2.

18. When the Floor Granted message is received in the floor participant 1, the floor participant 1 requests the MCPTT client to start encoding voice and send RTP media packets. The MCPTT client 1 starts encoding voice from the MCPTT user and sends RTP media packets over the unicast bearer towards the participating MCPTT function. The participating MCPTT function forwards the RTP media packets towards the controlling MCPTT function.

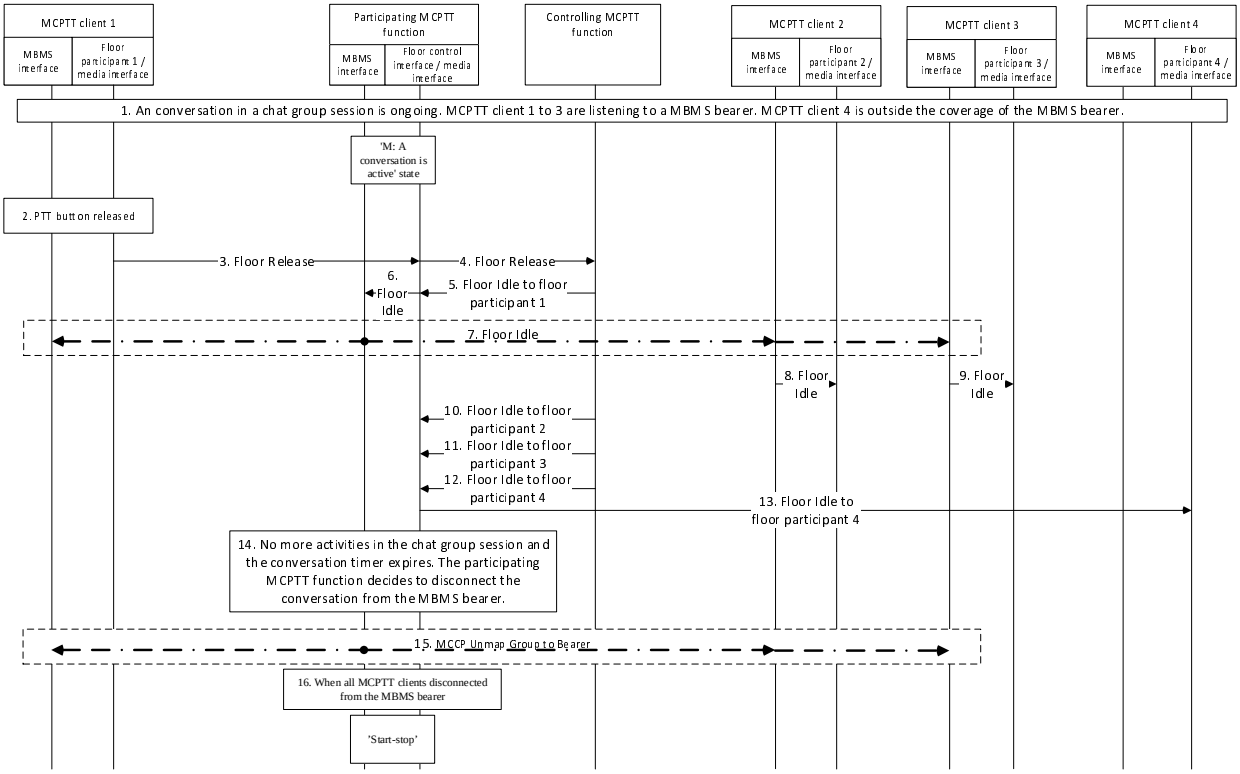
19-24. The controlling MCPTT function distributes the RTP media packets to all MCPTT clients. The participating MCPTT function sends one media stream over the MBMS subchannel associated with this group. If an MCPTT client is not listening to the MBMS bearer, in this example the MCPTT client 4, the participating MCPTT function forwards the RTP media packets to MCPTT client 1 over the unicast bearer.

As long as the conversation is active and the MBMS subchannel for this group is available any of the MCPTT users can request floor and the Floor Taken, Floor Idle and RTP packets are sent over the MBMS bearer.

A.6.4 Releasing floor and ending a conversation

This subclause describes how the participant 1 releases the floor and how the participating MCPTT function decides to end the conversation.

Figure A.6.4-1 shows the signalling flow.



NOTE: The arrows and boxes with dotted lines represent events sent over the MBMS bearer.

Figure A.6.4-1: Releasing floor and ending a conversation

The steps of the flow are:

1. The MCPTT clients 1 to 4 participate in a group session. All MCPTT clients are served by the same participating MCPTT function. The MCPTT clients 1 to 3 are within an area where a MBMS subchannel is used for the conversation. The MCPTT client 4 is outside this area and can only use a unicast bearer. At the moment the participant at MCPTT client 1 has the floor. The conversation over the MBMS bearer started as described in subclause A.6.4.

2. The MCPTT user at the MCPTT client 1 releases the PTT button. The MCPTT client 1 indicates to the floor participant 1 that the PTT button is released.

3-4. The floor participant 1 sends the Floor Release message over the unicast bearer. The participating MCPTT function forwards the message to the controlling MCPTT function.

5-13. The floor control server sends the Floor Idle message to all participants. The participating MCPTT function sends the first received Floor Idle message destined to an MCPTT client using the MBMS subchannel mentioned in step 1. Any other Floor Idle messages destined to an MCPTT client listening to the MBMS bearer are discarded. Any Floor Idle message destined to an MCPTT client outside the MBMS bearer coverage, in this case the MCPTT client 4, is forwarded over the unicast bearer to the floor participant.

14. The conversation ends. The conversation timer expires and the participating MCPTT server decides to end the conversation on this MBMS subchannel.

The conversation timer is a relative long timer and needed to avoid that inactive group sessions are unnecessarily occupying the MBMS subchannel. The MBMS subchannel can then be reused by other conversations in other group sessions.

15. The participating MCPTT function sends the Unmap Group to Bearer message over the MBMS subchannel. The MBMS interfaces in the MCPTT clients 1, 2 and 3 removes the association between the TMGI, the MBMS subchannel for audio and for floor control and the MCPTT group identity.

16. The participating MCPTT function continues to retransmit the Unmap Group to Bearer message until all MCPTT clients has moved to unicast. When all MCPTT client is listening to the unicast bearer, the participating MCPTT function enter the 'M: No conversation is active' state.

Annex B (informative): Media encapsulation for end-to-end distribution using MBMS bearers

Table B-1 shows specific header field values of the media plane packet from the originating MCPTT client, starting with the codec payload to the MCPTT server, from where it is distributed in downlink via IP multicast over MBMS to the terminating MCPTT clients. Each line represents a logical or physical "Entity" which handles the incoming packet (or generated packet for the first line) and passes it to the next "Entity" via the interface "Reference Point" indicated in this line. Additional entries of the line represent specific parts of the packet when it is put to the "Reference Point" by the "Entity". The rightmost column is the inner part of the packet. The parameters indicated in a column indicate the value of specific information elements set by the "Entity" in the header encapsulating all the parts to the right of the column.

All shown IP addresses (as s= for the source address and as d= as the destination address) can be IPv4 or IPv6 and are considered routable as necessary and distinct from each other within the same domain if they have different designations: it is up to the implementations to handle local IP addresses, perform NAT or use additional tunneling. UDP ports of different designations correspond to potentially different port numbers. The UDP port numbers are designated as capital letter within squared brackets.

The unicast IP address IP_1 and the sending UDP port [A] of the originator UE are as specified in the SDP during the most recent setup for the SIP session which precedes the MBMS distribution of MCPTT traffic. The multicast IP address IP_{5m} and the associated receiving UDP port [H] used for the distribution of media packets are provided to the terminating MCPTT clients via MCPTT signalling.

The SSRC is set to a value that uniquely identifies the originating MCPTT client during the (S)RTP session, in accordance to IETF RFC 3550 [3] and IETF RFC 3711 [8].

Table B-1 Media encapsulation for end-to-end distribution using downlink MBMS bearers

System	Entity	Reference Points	Media encapsulation for transmission (unicast uplink / MBMS downlink)							
			outer IP header	outer UDP port			inner IP header	inner UDP port	(S)RTP	Payload
Originating	*Codec*	<internal>								Codec payload
	MCPTT client (IP_1)	Unicast uplink (Uu-> S1-U -> S5 -> SGi)					s= IP_1 d= IP_2	[A] [B]	SSRC = unique id	(as above)
	MCPTT function (participating) (IP_2)	MCPTT-3					s= IP_2 d= IP_3	[C] [D]	(as above)	(as above)
Controlling	*MCPTT function (controlling)* (IP_3)	MCPTT-3					s= IP_3 d= IP_4	[E] [F]	(as above)	(as above)
Terminating	*MCPTT function (participating)* (IP_4)	MB2-U (NOTE 1)	s= IP_4 d= IP_6	[I] [J]			s= IP_4 d= IP_{5m}	[G] [H]	(as above)	(as above)
	BM-SC (IP_6)	SGimb	s= IP_6 d= IP_8	[K] [L]		SYNC header (NOTE 4)	(as above)	(as above)	(as above)	(as above)
	MBMS-GW (IP_8)	M1	s= IP_8 d=IP_{7m}	[M] [N]	GTP-U (NOTE 5)	(as above)	(as above)	(as above)	(as above)	(as above)
	eNB (IP_{7m}) (NOTE 2)	Uu downlink (MBMS)					(as above)	(as above)	(as above)	(as above)
	MCPTT client (IP_{5m}) (NOTE 3)	<internal>							(as above)	(as above)
	Codec									(as above)

NOTE 1: IP_6 and [J] are provided to the participating MCPTT function by the BM-SC over MB2-C reference point during the MBMS bearer activation procedure.
NOTE 2: IP_{7m} is given to eNBs when they are informed that the activated MBMS Bearer will be transmitted by them. Then the eNBs join this IP multicast address.
NOTE 3: The terminating MCPTT client starts listening for traffic on IP_{5m} and [H] when the group/media stream is mapped to this multicast IP address and port number respectively, via MCPTT signalling (Map Group To Bearer message).
NOTE 4: Specified in 3GPP TS 25.446 [9].
NOTE 5: Specified in 3GPP TS 29.281 [10].

Annex C (Informative): Floor control state machine transitions tables

C.1 Introduction

This annex contains state transitions tables.

C.2 Off-network tables

C.2.1 Off-network call floor control state machine transitions

The table is a representation of the off-network call floor control state machine in terms of:

1) the resulting state, and
2) the actions to be done;

as a function of:

3) the current state, and
4) the trigger causing the transition.

The trigger is either an external event, an input coming externally to the state machine or an auxiliary internal even like the expiry of a timer or a counter.

Examples for an action to be done are the transmission of a message, initiation of a timer or a counter etc.

Table C.2.1-1 shows the off-network group call floor control transitions.

Table C.2.1-1: Off-network group call floor control transitions

Current State	Trigger	Resulting State	Remarks
O: silence	R: Floor Granted to other	O: has no permission	Another client took the floor.
	R: RTP media	O: has no permission	Another client took the floor.
	PTT Button pressed	O: pending request	MCPTT User indicated to transmit media. Client contends for floor.
	R: Floor Request	O: pending granted	Another client requested floor (only private call)
	R: Floor Taken	O: has no permission	Another client took the floor.
	R: MCPTT call release	Start-stop	Call ended. Release floor control entity.
	Timer T230 (during silence) expiry	Start-stop	No floor activity for long. Assume call ended. Release floor control entity.
O: has no permission	R: Floor Granted to other	O: has no permission	Another client received floor; stop rendering media.
	R: RTP media	O: has no permission	Current arbitrator speaking. Render media.
	PTT Button pressed	O: pending request	MCPTT User indicated to transmit media. Client contends for floor.
	R: Floor Release	O: silence	Current arbitrator released the floor.
	T203 (end of RTP media)	O: silence	No media for long. Assume silence.
	R: MCPTT call release	Start-stop	Call ended. Release floor control entity.
	Timer T230 (during silence) expiry	Start-stop	No floor activity for long. Assume call ended. Release floor control entity.
O: pending request	Timer T201 (Floor Request) expiry	Conditional -	O: has permission if the associated counter reached N. Otherwise, O: pending request
	R: Floor Granted to me	O: has permission	Contention won. Client is the new Floor Arbitrator.
	R: Floor Deny	O: has no permission	The request was denied.
	R: RTP media	O: pending request	Render media. Reset counter associated with T201.
	R: Floor Granted to other	O: pending request	Another client received floor; stop rendering media.
	R: Floor Request	O: pending request	Another client requested floor, reset counter associated with T201.
	R: Floor Taken	O: pending request	Another client took the floor.
	R: Floor Queue Position Info	O: queued	If own queue position is received.
	PTT Button released	O: silence	MCPTT User indicated to end floor contention.

Current State	Trigger	Resulting State	Remarks
	R: MCPTT call release	Start-stop	Call ended. Release floor control entity.
	Timer T230 (during silence) expiry	Start-stop	No floor activity for long. Assume call ended. Release floor control entity.
O: queued	User indication to accept grant of pending request	O: has permission	Only after 'floor granted to me' is received. Otherwise, ignore.
	R: Floor Deny	O: has no permission	Queued request was denied.
	Timer T233 (pending user action) expiry	O: silence	No response from user.
	User releases floor	O: has no permission	Send a floor release message.
	Timer T203 (end of RTP media) expiry	O: pending request	Send Floor request message and start timer T201.
	R: Floor Granted to me	O: queued	Wait for user action. Start timer T233.
	R: Floor Granted to other	O: queued	Another client received floor; stop rendering media.
	R: Floor Queue Position Info	O: queued	Update queue position.
	R: RTP media	O: queued	Render the media.
	R: Request queue position info	O: queued	Update info.
	R: MCPTT call release	Start-stop	Call ended. Release floor control entity.
	Timer T230 (during silence) expiry	Start-stop	No floor activity for long. Assume call ended. Release floor control entity.
	Timer T204 (Floor Queue Position request) expires	Conditional -	if the associated counter has reached maximum value enter O: silence, otherwise, restart Timer T204
O: has permission	PTT Button released	Conditional -	O: pending granted if request(s) are pending in Queue. Otherwise, O: silence
	R: Floor Request	Conditional -	O: pending granted if the request is of higher priority. Otherwise, Queue or ignore.
	R: Floor Release	O: has permission	A client released contention, remove from Queue.
	R: Floor Queue Position Request	O: has permission	Respond by sending Floor Queue Position Info.
	R: MCPTT call release	Start-stop	Call ended. Release floor control entity.
	Timer T230 (during silence) expiry	Start-stop	No floor activity for long. Assume call ended. Release floor control entity.
O: pending granted	R: RTP media	O: has no permission	New floor arbitrator took control.
	Timer T205 (Floor Granted) expiry	O: Conditional	if the associated counter has reached maximum value, enter O: silence if there are no pending requests or enter O: pending granted if there are pending request(s). Otherwise, restart Timer T205

Current State	Trigger	Resulting State	Remarks
	PTT button pressed	O: pending granted	Reject the request internally.
	R: Floor Request	O: pending granted	Send Floor Deny message as it can result in unsynchronised queue.
	R: Floor release	O: pending granted	Remove the sending user from queue.
	Timer T233 (pending user action) expiry	Conditional -	If queue not empty, restart timer T205 and grant to next in queue. Otherwise, move to 'O: silence'.
	R: MCPTT call release	Start-stop	Call ended. Release floor control entity.
	Timer T230 (during silence) expiry	Start-stop	No floor activity for long. Assume call ended. Release floor control entity.
Start-stop	Group Call established as originating user	O: has permission	The client initiated the call.
	Group Call established as terminating user	O: silence	The client responded to the call.
	Private Call established as terminating user	O: has no permission	The client responded to the call.
	Broadcast Call established as terminating user	O: has no permission	The client responded to the call.
	PTT button pressed	O: pending request	MCPTT User indicated to transmit media. Client contends for floor.
	R: Floor Taken	O: has no permission	Another client took the floor.
	R: RTP media	O: has no permission	Another client took the floor.
	R: Floor Granted to other	O: has no permission	Another client took the floor.

Annex D (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2015-07					Initial proposal to CT1	-	0.0.0
2015-07					Contains agreed P-CRs from CT1#92-bis: C1ah-150040, C1ah-150041 (+C1ah-150049, see comment column), C1ah-150045,	0.0.0	0.1.0
2015-08					Contains agreed P-CRs from CT1#93: C1-152582, C1-152852, C1-152960, C1-152961	0.1.0	0.2.0
2015-08					minor fixes from the rapporteur	0.2.0	0.2.1
2015-09					Specification numbers decided by CT#69 are indicated by the rapporteur	0.2.1	0.2.2
2015-10					Contains agreed P-CRs from CT1#94: C1-153357, C1-153361, C1-153364, C1-153486, C1-153487, C1-153489, C1-153626, C1-153709, C1-153710, C1-153712, C1-153713, C1-153713, C1-153714, C1-153752, C1-153806, C1-153807, C1-153808, C1-153853, C1-153854	0.2.2	0.3.0
2015-10					Contents list updated and minor editorial corrections	0.3.0	0.3.1
2015-11					Contains agreed P-CRs from CT1#95: C1-154086, C1-154085, C1-154050, C1-154053, C1-154076, C1-154077, C1-154079, C1-154080, C1-154081, C1-154082, C1-154084, C1-154284, C1-154285, C1-154287, C1-154288, C1-154332, C1-154333, C1-154342, C1-154469, C1-154470, C1-154481, C1-154482, C1-154483, C1-154484, C1-154485, C1-154486, C1-154488, C1-154489, C1-154490, C1-154491,C1-154583, C1-154584, C1-154585, C1-1544586, C1-154587, C1-154589, C1-154592, C1-154719	0.3.1	0.4.0
2015-12	CT-70	CP-150734			Version 1.0.0 created for presentation for information	0.4.0	1.0.0
2016-01					Contains agreed P-CRs from CT1#95bis: C1-160009, C1-160012, C1-160015, C1-160016, C1-160017, C1-160044, C1-160045. C1-160047, C1-160061, C1-160072, C1-160079, C1-160086, C1-160088, C1-160089, C1-160119, C1-160376, C1-16401, C1-160402, C1-160403, C1-160404, C1-160405, C1-160408, C1-160409, C1-160410, C1-160411, C1-160412, C1-160413, C1-160492, C1-160493, C1-160513, C1-160514, C1-160515, C1-160516, C1-160517, C1-160518, C1-160519, C1-160520, C1-160521	1.0.0	1.1.0
2016-02					Contains agreed P-CRs from CT1 MCPTT AD-Hoc and CT1#96: C1-161019, C1-161020, C1-161021, C1-161022, C1-161023, C1-161025, C1-161029, C1-161032, C1-161034, C1-161035, C1-161036, C1-161059, C1-161060, C1-161097, C1-161215, C1-161216, C1-161219, C1-161220, C1-161221, C1-161233, C1-161314, C1-161316, C1-161317, C1-161318, C1-161319, C1-161320, C1-161321, C1-161322, C1-161325, C1-161442, C1-161443, C1ah-160015, C1ah-160018, C1ah-160020, C1ah-160021, C1ah-160042, C1ah-160043, C1ah-160069, C1ah-160072, C1ah-160081, C1ah-160096 Various corrections and alignments by the Rapporteur.	1.1.0	1.2.0
2016-02					Further corrections by rapporteur	1.2.0	1.2.1
2016-03	CT-71	CP-160060			Version 2.0.0 created for presentation for approval	1.2.1	2.0.0
2016-03	CT-71				Version 13.0.0 created after approval	2.0.0	13.0.0
2016-03					Clean up by rapporteur	13.0.0	13.0.1
2016-03					Further clean up	13.0.1	13.0.2

History

Document history		
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