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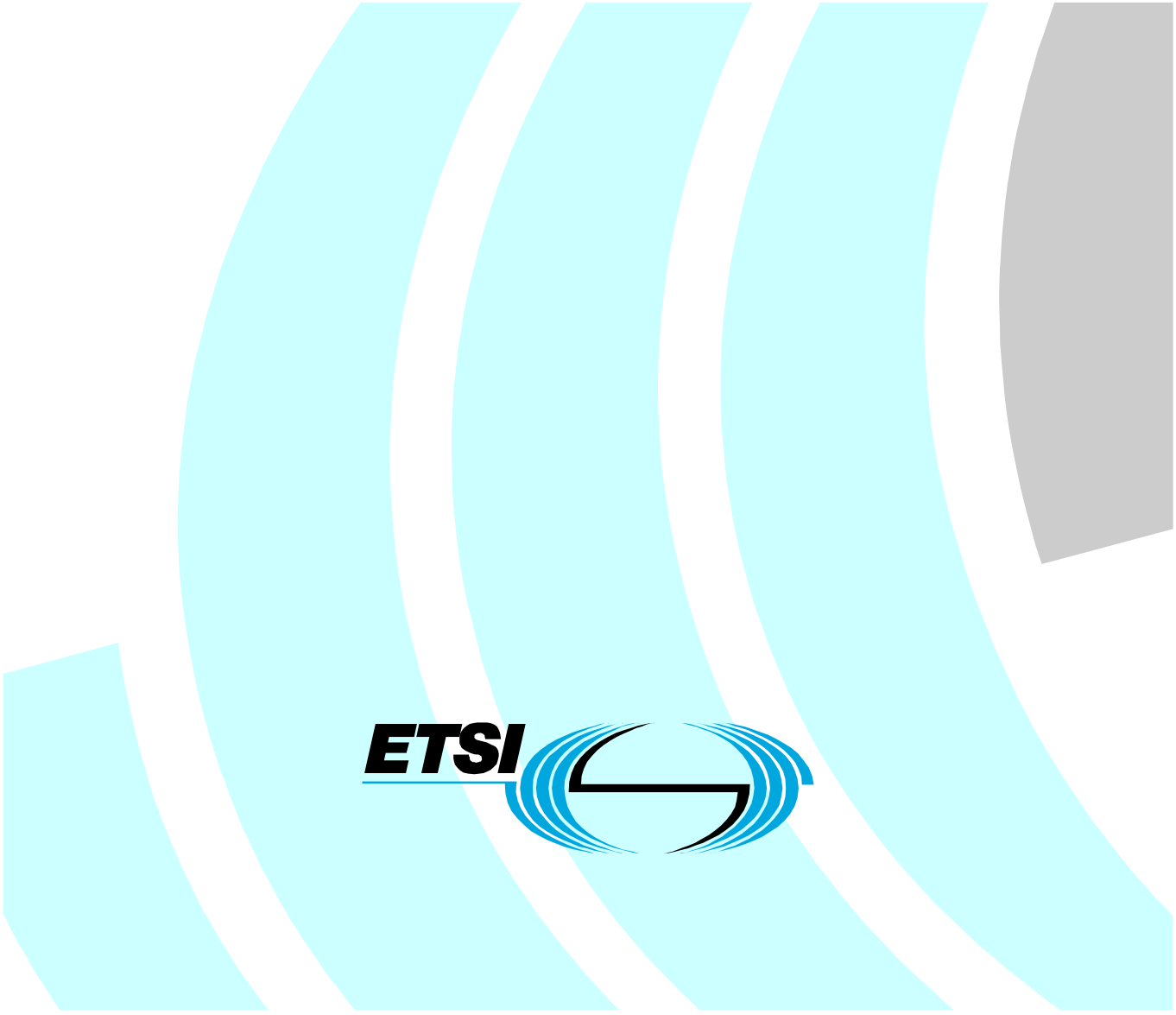
Technical Specification

Satellite Earth Stations and Systems (SES);
Broadband Satellite Multimedia (BSM);
Regenerative Satellite Mesh - B (RSM-B);
DVB-S/DVB-RCS family for regenerative satellites;
Part 3: Connection control protocol



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Contents

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

The present document is part 3 of a multi-part deliverable covering the Broadband Satellite Multimedia (BSM) Regenerative Satellite Mesh - B (RSM-B); DVB-S/DVB-RCS family for regenerative satellites, as identified below:

Part 1: "System overview";

Part 2: "Satellite Link Control layer";

Part 3: "Connection control protocol";

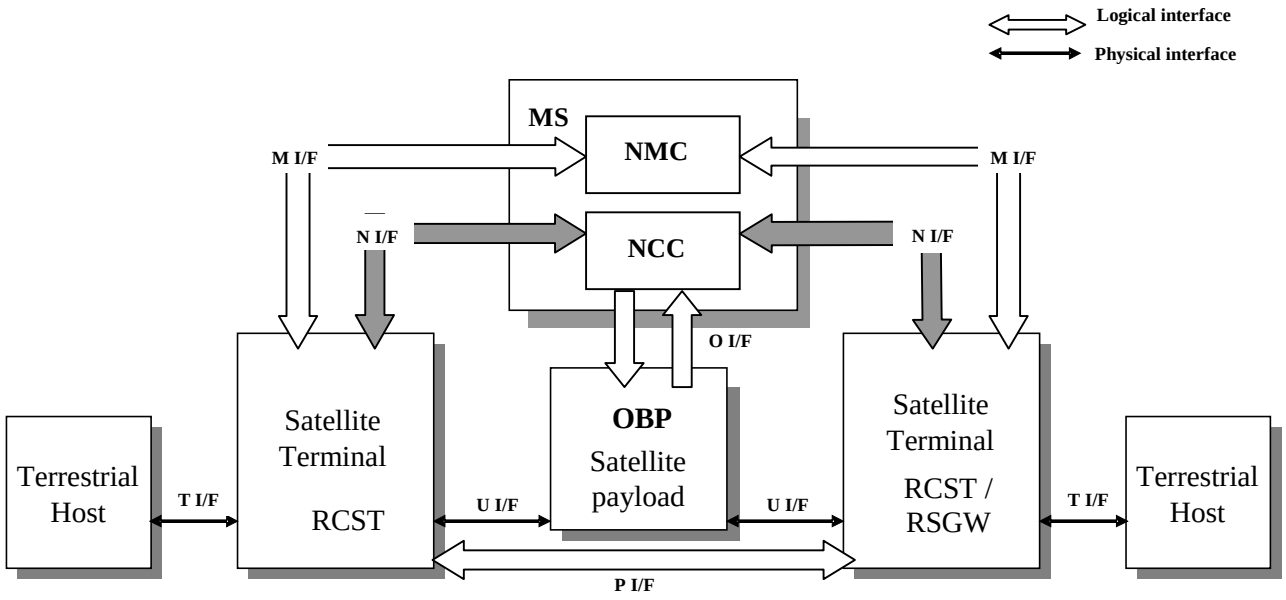
Part 4: "Specific Management Information Base".

1 Scope

The present document defines the Connection Control Protocol (C2P) used within SES BSM Regenerative Satellite Mesh – B (RSM-B) to provide connections in a DVB-RCS network using Type A terminals.

The C2P is the protocol used for NCC and RCST communication (N interface) . The information elements used to build the C2P messages are identical to the ones defined in EN 301 790 [1] and TR 101 790. The present document includes the definition of the C2P messages and protocol procedures required to support RSM-B system as a connection oriented network.

The aim of the present document is a complement for the DVB-RCS and DVB-S standards defining the NCC and RCST interface to ensure RSM-B interworking with IP multimedia networks and services.



NOTE: See clause 4.1.5 of TS 102 429-1 (see bibliography) for interfaces definition.

Figure 1.1: Network architecture

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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

[1] ETSI EN 301 790: "Digital Video Broadcasting (DVB); Interaction channel for satellite distribution systems".

[2] IETF RFC 1112: "Host Extensions for IP Multicasting".

[3] ITU-T Recommendation H.222.0: "Information technology - Generic coding of moving pictures and associated audio information: Systems".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in EN 301 790 [1] and the following apply:

Connection Control Protocol (C2P): protocol that provides the interaction between RCSTs and NCC to support set-up, modification and release of connections and channel bandwidth modification

control plane: the control plane has a layered structure and performs the connection control functions; it deals with the signalling necessary to set up, supervise and release connections

Digital Video Broadcasting Return Channel by Satellite (DVB-RCS): protocol for an interaction (or return) channel in satellite links

Digital Video Broadcasting via Satellite (DVB-S): protocol for broadcasting TV signals and by extension data over satellite

management plane: plane which provides two types of functions, namely layer management and plane management functions

Management Station (MS): controls and manages the RSM-B network and is composed of three elements:

- the Network Control Center (NCC);
- the Network Management Center (NMC);
- the satellite terminal of the MS (NCC_RCST), which supports the modulation and demodulation functions to access to the satellite.

multicast: communication capability, which denotes unidirectional distribution from a single source access point to a number of specified destination, access points

Network Control Center (NCC): RSM-B network element which controls the Interactive Network, serves users satellite access, and manages the OBP configuration

Network Management Center (NMC): RSM-B network element composed in charge of element management functions and for the network and service provisioning and management

On Board Processor (OBP): satellite payload digital processor on-board the satellite that allows MPEG packets switching from up-link to down-link beams in a flexible way

Return Channel Satellite Terminal (RCST): low cost and high performance RSM-B network element installed in the user premises that provides interfaces with final users and allows its users access to users of others RCSTs or to external users of terrestrial networks through the RSGW, or to services delivered by the Service Provider attached to the RSGW

GateWay Return Channel Satellite Terminal (GW_RCST): RSM-B RCST installed inside an RSGW with enhanced properties in routing, IP multicast, connection control and management

Regenerative Satellite GateWay (RSGW): RSM-B network element that provides the interface between RSM-B network and external users of terrestrial networks such as PSTN or ISDN and with external Service Providers

NOTE: A Gateway and one or several GW_RCST (Gateway Return Channel Satellite Terminal) compose the RSGW. A Gateway includes all the network elements that will assure the interface with terrestrial networks (e.g. IP router, Voice gateway, Video gateway, Gatekeeper, etc.).

Quality of Service (QoS): measure of the parameters of a network that influence perceived quality of communications, including the delay, jitter, bandwidth, and packet loss that packets sent by the application experience when being transferred by the network

user plane: plane which has a layered structure and provides user information on flow transfer, along with associated controls for flow control and recovery from errors

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in EN 301 790 [1] and the following apply:

BE	Best Effort
BSM	Broadband Satellite Multimedia
BW	BandWidth
ChModReq	Channel Modify Request
ChModResp	Channel Modify Response
cnx	connection
CnxEstReq	Connection Establishment Request
CnxEstResp	Connection Establishment Response
CnxRelReq	Connection Release Request
CnxRelResp	Connection Release Response
CRA	Constant Rate Assignment
CRC	Cyclic Redundancy Check
DiffServ	Internet Differentiated Services
DSCP	DiffServ Code Point
DULM	Data Unit Labelling Method
DVB	Digital Video Broadcasting
DVB-RCS	Digital Video Broadcast-Return Channel by Satellite
DVB-S	Digital Video Broadcasting by Satellite
ETSI	European Telecommunications Standards Institute
fwd	forward
GRD	Guaranteed Rate & Delay
IE	Information Element
IETF	Internet Engineering Task Force
IGMP	Internet Group Management Protocol
IP	Internet Protocol
IPSec	IP Security
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
ITU	International Telecommunication Union
kbps	kilo bits per second (thousands of bits per second)
M&C	Management & Control
Mbps	Mega bits per second (millions of bits per second)
MF-TDMA	Multi-Frequency Time Division Multiple Access
MMT	Multicast Map Table
MSB	Most Significant Bit
NCC	Network Control Center
NMC	Network Management Center
NSM	Network and Service Manager
OBP	On Board Processor
PDR	Peak Data Rate
PID	Program IDentifier
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RBDC	Rate Based Dynamic Capacity
RCST	Return Channel Satellite Terminal
RSGW	Regenerative Satellite GateWay
RSM	Regenerative Satellite Mesh
rtn	return
SDR	Sustainable Data Rate
SNMP	Simple Network Management Protocol

TBTP	Time Bursts Time Plan
TDM	Time-Division Multiplex
TDMA	Time Division Multiple Access
TIM	Terminal Information Message
TRF	Traffic (burst type)
TS	Transport Stream
UI	User Interface
uimsbf	unsigned integer most significant bit first
UVR	Unguaranteed Variable Rate
VCI	Virtual Channel Identifier
VPI	Virtual Path Identifier

4 Connection Control overview

4.1 Protocol description

The aim of RSM-B Connection Control Protocol is to enhance the control plane of a RSM-B system adding the following characteristics:

- Dynamic control of the set of communicating parties in RSM-B system for both mesh and star topology.
- Quality of Service driven dynamic allocation of bandwidth resources to communications.
- Dynamic allocation of PID or VPI/VCI.
- Configuration of the Route_ID.
- Assignment of the Channel_ID.
- Identification of the destination hub in multi-Gateway configurations.

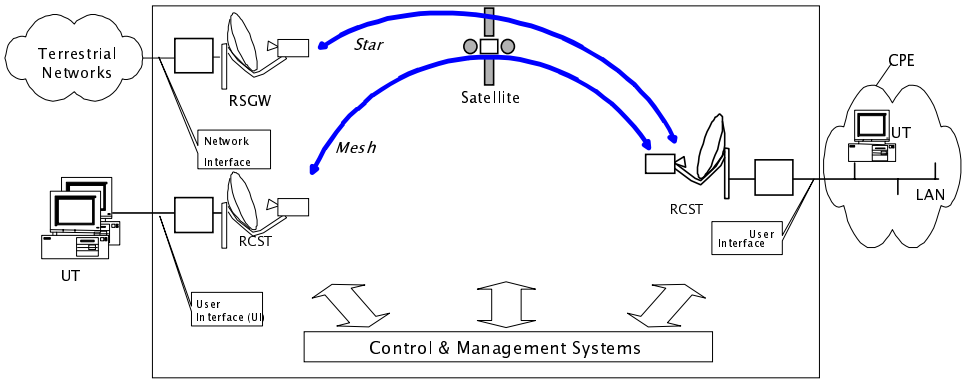


Figure 4.1: RSM-B Network Contour

The Connection Control Protocol (C2P) supports set-up, modification and release of connections and channel bandwidth modification. C2P provides quality of service driven by dynamic allocation of bandwidth resources to communications and DVB-RCS parameters as well as embedded ARP (Address Resolution Protocol).

4.2 C2P definitions

4.2.1 Connection

A connection is defined as the means to propagate packets (traffic or signaling) with the same priority level from one RSM-B network reference point to one (unicast) or more (multicast or broadcast) distant RSM-B network reference points. These RSM-B network reference point correspond to RSM-B RCSTs or RSGWs.

Between two RCSTs/RSGWs there can be as many connections as different priority levels are defined in the System. In RSM-B system there are 4 different levels of priority. Therefore for RSM-B system a maximum of 4 connections may be established between two RCSTs/RSGWs.

Each connection is identified thanks to a connection_reference_id. This identifier allows each RCST/RSGW to locally identify all the active connections present.

The Connection Control Protocol (C2P) "IE" (Information Element) fields allow to associate various attributes to the connection according to end user service needs.

4.2.2 IP flow

A connection may carry one or several unitary IP flows. Each RCST (or RSGW) will be capable of identifying IP flows thanks to a multifield classification.

EXAMPLE: An IP flow may be identified in terms of IP source and destination addresses, DSCP value, protocol type and source and destination port numbers.

The multifield filtering criteria is configured thanks to a Type of Flow table on each RCST (or RSGW), see TS 102 429-4 (bibliography).

4.2.3 Channel

Channel is the logical access link between an RCST(or RSGW) and all its destination RCSTs (or RSGW) sharing the same beam. A Channel is associated to a physical route and to a specific MF-TDMA uplink resource through the TBTP. It is possible to map either a single or N connections to one Channel depending on quality of service and routing considerations. The whole capacity allocated per channel is shared between all the connections established on this channel.

Each channel is identified thanks to a Channel_ID.

4.2.4 Stream

RSM-B system is based on the MPEG-2 TS profile of EN 301 790 [1]. Therefore each connection will be identified in terms of MPEG-2 TS stream identifiers.

In case of a bidirectional connection, two stream identifiers would identify the transmission and reception of traffic. In case of a unidirectional connection, only one stream identifier is required for the transmission of traffic.

These stream identifiers are also called PIDs, Program Identifier, following MPEG2 TS nomenclature.

As a summary, the following figure represents the relationship between all previous parameters and identifiers: connection, stream, channel, and spot beams (TDM).

The figure illustrates a typical arrangement of unicast connections from one RCST-A attached to one single sub-net transmitting traffic towards the TDM 1:

- a high priority connection towards RCST3 is identified by (ch_id-1, PID A-1 HP, MAC address RCST3);
- a low priority connection towards RCST2 is identified by (ch_id-1, PID A-1 LP, MAC address RCST2).

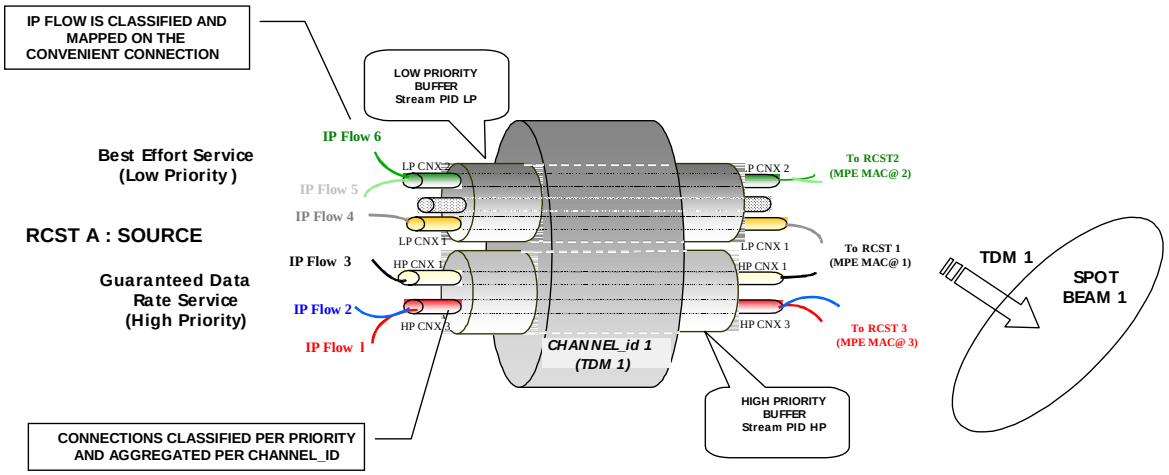


Figure 4.2: Connection, channel_ID and PIDs arrangement

4.3 Connection types

Signaling connections for control and management messages are differentiated from user data traffic connections.

4.3.1 Control and management connection

The communication between the MS (NCC&NMC) and the RCSTs is done thanks to signaling connections. A signaling connection may convey only control and management information.

Signalling connections are implicitly opened at terminal logon without the utilization of C2P messages. All the information required for a signaling connection is contained in the logon messages received by the RCST.

Signalling connections are required to send:

- C2P control message to the NCC.
- Management SNMP messages to the NMC.

Each connection will have different PID values for transmission and reception assigned thanks to the logon messages. Different internal queue buffers will be assigned to each signaling connection in the RCST. Both connections will share the timeslots allocated on the reserved signaling channel_ID 0.

These connections correspond to the control and management plane of the RCST.

4.3.2 Traffic connection

The communication between several RCSTs and RSGWs involves only traffic data. These are denominated traffic connections.

Traffic connection may be mesh or star, bi-directional or uni-directional, unicast or multicast between 2 or more terminals (RCST or RSGW) and belong to the User Plane of the RCST.

4.3.2.1 Permanent and on_demand connections

Traffic connections can be established, or released:

- by management (NMC), initiated by the NCC: permanent connections;
- initiated by the RCST (or RSGW): on_demand connections.

Permanent connection: Established upon NMC initiative when the peer terminals are synchronized. Permanent connection establishment and release procedures are performed using C2P . C2P permanent connection establishment/release is initiated by the NCC Connection Control function (when indicated by the NMC) and never released by terminals.

On-demand connection: Established upon explicit request from the RCST or RSGW. On-demand connection establishment and release procedures are performed using C2P and are initiated by the RCST or RSGW Connection Control function.

4.3.2.2 Star and mesh connections

Traffic connections are differentiated depending if it involves a RSGW or not.

Star connection: Connection established between a RSGW and an RCST.

Mesh connection: Connection established between two user RCSTs.

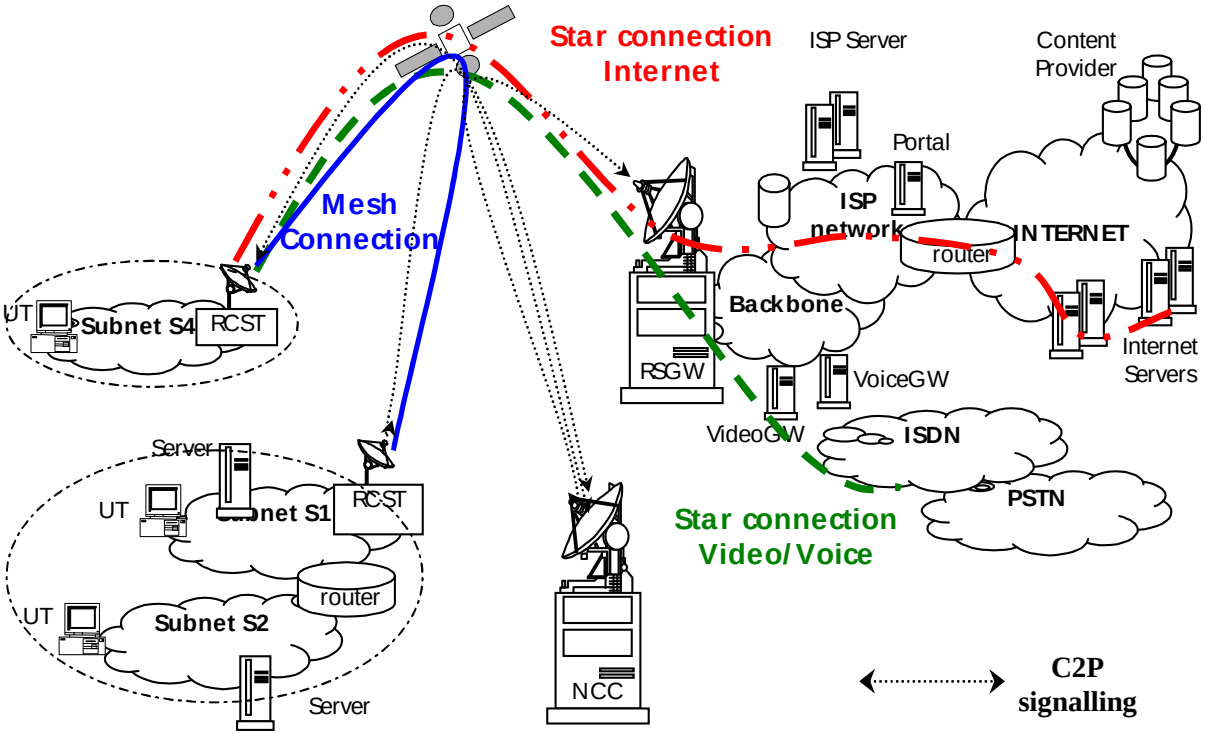


Figure 4.3: Star and Mesh connections

4.4 C2P messages

The Connection Control Protocol (C2P) supports the following messages:

- Connection establishment request (point-to-point or point-to-multipoint).
- Connection establishment response (point-to-point or point-to-multipoint).
- Connection release request.
- Connection release response.
- Connection modify request (/profile, /join, /release).
- Connection modify response (/profile, /join, /release).
- Channel modify request.

- Channel modify response.

The information elements of Connection Control Protocol messages are:

- Message Header: message type and length and connection identifier assigned by C2P.
- Cause: message response cause.
- Channel_ID: transmission channel as defined in DVB-RCS standard.
- Source Address: source address field.
- Destination Address: destination address field.
- Forward stream identifier: forward or reception PID of the connection.
- Return stream identifier: return or transmission PID of the connection.
- Type: connection configuration type: direction and casting.
- Forward Profile: priority and overall amount of resources for the connection forward or reception stream.
- Return Profile: priority and overall amount of resources for the connection return or transmission stream.

The Connection Control Protocol is supported by:

- from RCST to NCC: DULM messages (including RCST identification through its Group_ID and Log-on_ID assigned at logon).
- from NCC to RCST: TIM unicast messages embedded in DSM-CC private sections carried by the FLS (including RCST identification through its MACaddress contained in the DSM-CC header, and the Connection_control_descriptor).

4.4.1 Connection profile parameters

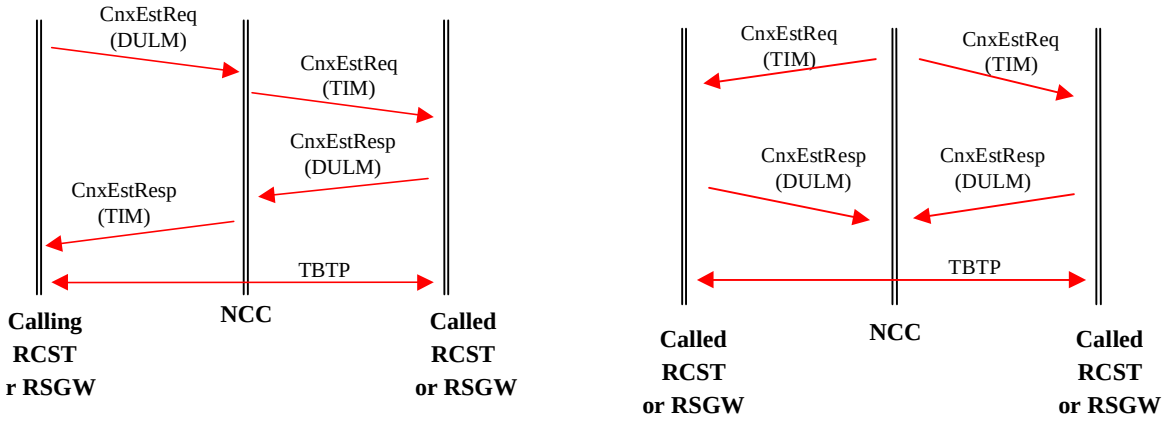
C2P parameters are handled by the connection control and interpreted by the resource control to map a convenient allocation mode and resource to the connection.

The C2P parameters handled by the NCC are:

- **Peak Data Rate (PDR):** corresponds to the maximum data rate supported by the connection.
- **Sustainable Data Rate (SDR):** corresponds to the sustainable and guaranteed data rate expected by the connection.
- **Priority:** to determine the traffic priority class for the connection.

5 Connection Control procedures

5.1 Point-to-Point connection establishment

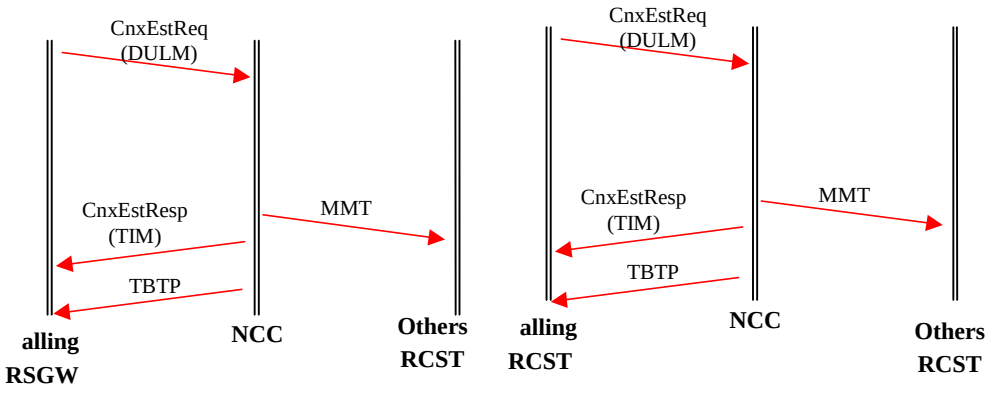


initiated by RCST **initiated by NCC**

NOTE 1: Connections may be established between two RCSTs, between two RSGWs, or between a RCST and a RSGW.
NOTE 2: For permanent connections (established upon NCC initiative), the TBTP corresponding to new assignments **may** be sent by the NCC before sending the C2P Connection Establishment Request messages.
NOTE 3: For permanent connections, both endpoint RCSTs are considered as called terminal.

Figure 5.1: Point-to-Point connection establishment

5.2 Point-to-Multipoint connection establishment



initiated by RSGW (Star multicast) **initiated by RCST** (Mesh multicast)

NOTE: In case of multicast connection, the source of the multicast session corresponds to the calling RCST or calling RSGW.

Figure 5.2: Point-to-Multipoint connection establishment

5.3 Point-to-Point connection release

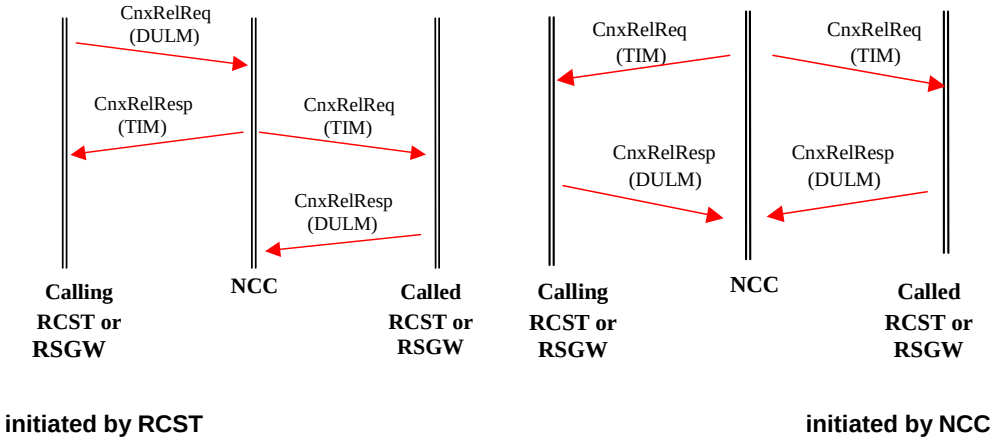


Figure 5.3: Point-to-Point connection release

5.4 Point-to-Multipoint connection release

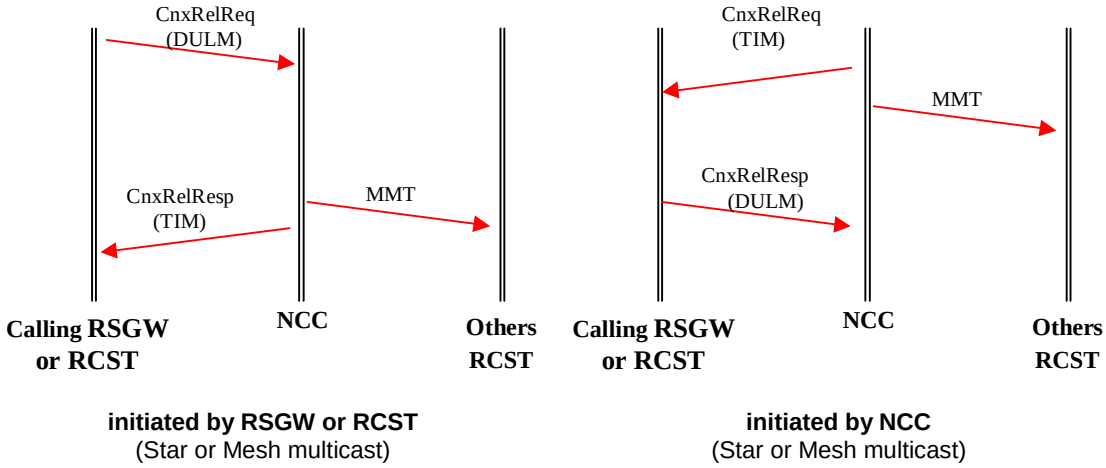


Figure 5.4: Point-to-Multipoint connection release

5.5 Connection modify

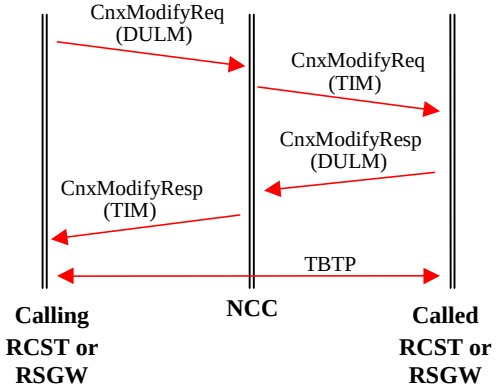


Figure 5.5: Connection modify initiated by RCST/RSGW

5.6 Channel modify

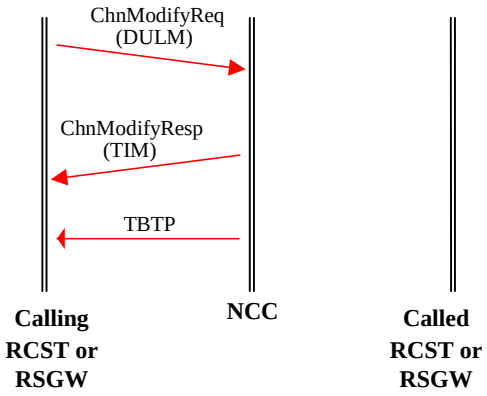
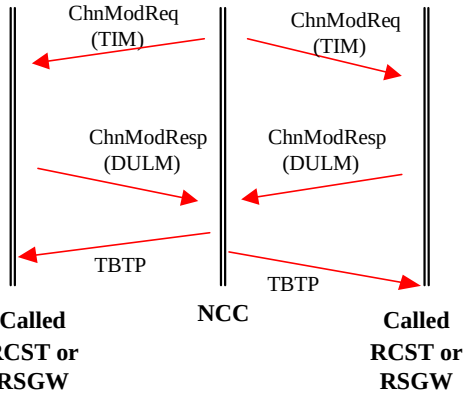


Figure 5.6: Channel modify initiated by RCST/RSGW



NOTE: For on-demand connections, channel modify will be initiated by the RCST / RSGW.
For permanent connections, channel modify will be initiated by the NCC.

Figure 5.7: Channel modify initiated by NCC

6 Connection Control Message Formatting

6.1 RCST to NCC messages

6.1.1 DULM format

Following EN 301 790 [1], C2P messages from RCSTs to NCC use DULM encapsulation.

For the RCSTs using the optional MPEG TRF bursts, a CTRL/MGNM PID shall be used in the header of CTRL/MNGM bursts. This PID is obtained by the RCST during the logon procedure as detailed in TS 102 429-2 (see bibliography).

The DULM format for MPEG profile and related Information Elements (IEs) semantics are recalled in table 6.1.

Table 6.1: DULM format over MPEG

Message field	Description	Length
MPEG-2 Header		32 bits
Group_ID		8 bits
Logon_ID		16 bits
IE Type (1)	Type of information carried by IE	5 bits
N/C	0 = New IE 1 = Continuation of IE	1 bit
F/C	0 = IE finishes in this MPEG packet 1 = IE continues in next MPEG packet	1 bit
L/C	0 = IE is the last of this MPEG packet 1 = Another IE follows in this MPEG packet	1 bit
IE Segment Length (1)	Length of the part of the IE included in this MPEG packet	8 bits
IE (1)	IE content	8 bits
IE (1)	IE content	
IE (1)	IE content	8 bits
IE Type (2)	Type of information carried by IE	5 bits
N/C	0 = New IE 1 = Continuation of IE	1 bit
F/C	0 = IE finishes in this MPEG packet 1 = IE continues in next MPEG packet	1 bit
L/C	0 = IE is the last of this MPEG packet 1 = Another IE follows in this MPEG packet	1 bit
IE Segment Length (2)	Length of the part of the IE included in this MPEG packet	8 bits
IE (2)	IE content	

NOTE 1: When an IE spans over several MPEG packets, the IE header is duplicated on these MPEG packets with N/C = 0, F/C = 1, L/C = 0 for first one, N/C = 1, F/C = 1, L/C = 0 for the following ones, and N/C = 1, F/C = 0, L/C = x for the last one.
NOTE 2: Padding bytes set to all "0" are appended to the last IE (L/C = 0) of a MPEG packet.
NOTE 3: The PUSI bit embedded in MPEG header of DULM C2P messages shall be ignored by the NCC.

Table 6.2: IE Type description

IE type	Size (bytes)	Value (Hex format)
Capacity Request	2	0x00
M&C	2	0x01
Reserved		0x02
Message Header	3	0x03
Cause	2	0x04
Channel_ID	1	0x05
Source Address	6	0x06
Destination Address	6	0x07
Forward Stream Identifier	3	0x08
Return Stream Identifier	3	0x09
Type	1	0x0A
Forward Profile	3	0x0B
Return Profile	3	0x0C
Security Sign-on Response	8	0x0D
Route_ID (only for ATM profile)	1	0x0E
Reserved		0x0F - 0x10
Main Key Exchange Response		0x11
Reserved		0x12
Quick Key Exchange Response		0x13
Reserved		0x14
Explicit Key Exchange Response		0x15

IE type	Size (bytes)	Value (Hex format)
Reserved		0x16 - 0x1E
Wait		0x1F

- Message Header: identifies the type of message, sets the total length in byte of the C2P message and identifies the connection affected by the connection control signaling.
- Cause: conveys the reason for the reject of a previous request.
- Channel_ID: defined and used according to DVB-RCS standard.
- Source Address: address of the calling end point.
- Destination Address: address of the called end point(s).
- Fwd stream identifier: it identifies a single forward information flow pertaining to the connection; a single PID for MPEG-2 nature information reception.
- Rtn stream identifier: it identifies a single return information flow pertaining to the connection; a single PID for MPEG-2 nature information transmission.
- Type: describes the connection configuration in terms of direction and casting.
- Fwd Profile: describes the priority and overall resources amount of connection forward streams, in other words, the reception parameters from the RCST point of view.
- Rtn Profile: describes priority and overall resources amount of connection return streams, in fact, the transmission parameters from the RCST point of view.

- **IE segment length:**
  - It indicates the length of the part of the IE included in this MPEG packet, in number of bytes, from byte immediately following the "segment length" field.

6.1.2 Message Header IE

Table 6.3: Message Header IE

Message Header IE (0x03) fields	Size (bits)	Value/Comments
Message Description	8	Message Description provides information about: - Message type: type of signaling message being transferred - Addressing type: addressing scheme used by the signaling message that determines the interpretation of the fields source and destination address as specified in clause 6.1.6
Message Length	8	C2P message length in bytes, from the 1st IE type byte to end of last IE of the C2P message, as defined in TR 101 202.
Connection Reference	16	Local connection identifier 16 bits uimsbf encoded (unsigned integer MSB first) - see ISO/IEC 13818-1 (see bibliography), with most significant bit set as follows: - "0" when Connection Reference Id is set by RCST - "1" when Connection Reference Id is set by NCC
NOTE: For channel modify C2P messages, connection_reference_id shall be ignored from the message header.		

- **Message Description:**

Table 6.4: Message and addressing types

Message Description	Size (bits)	Value/Code	
Message Type	5 bits uimsbf	CnxEstReq	0x01
		CnxEstResp	0x02
		CnxRelReq	0x03
		CnxRelResp	0x04
		CnxModifyReq/Profile	0x05
		CnxModifyResp/Profile	0x06
		CnxModifyReq/Join	0x07
		CnxModifyResp/Join	0x08
		CnxModifyReq/Leave	0x09
		CnxModifyResp /Leave	0x0A
		ChnModifyReq	0x0B
		ChnModifyResp	0x0C
		Reserved	0x0D to 0x1F
Addressing type	3 bits uimsbf	Source MAC address Destination MAC address	0x00
		Source MAC address Destination IP address	0x01
		Source MAC address list of source IP masks	0x02
		Destination MAC address list of destination IP masks	0x03
		Source IP address Destination IP address	0x04
		No addresses specified	0x05
		Source MAC address Source IP mask	0x06
		Destination MAC address Destination IP mask	0x07
NOTE: In case of 0x05 code "No Address specified", source and destination address fields should not be present in the C2P message.			

6.1.3 Cause IE

Table 6.5: Cause IE

Cause IE (0x04)	Size (bits)	Value/Code	
Cause type	16	Success	0x0000
		NCC refuses connection	0x0001
		Called RCST refuses connection	0x0002
		Unknown destination	0x0003
		No more PIDs available in the system	0x0004
		QoS cannot be guaranteed	0x0005
		Called RCST capacity exceeded	0x0006
		No more channel_IDs available	0X0007
		Called RCST not synchronized	0x0008
		NCC closes connection	0x0009
		No answer	0x000A
		Unexpected event	0x000B
		Not enough BW	0x000C
		BW excess	0x000D
		Calling RCST capacity exceeded	0x000E
		WrongParameter	0x000F
		Other	0x0010
		Reserved	0x0010 to 0xFFFF
NOTE: When a particular QoS parameter cannot be committed by the NCC (e.g. a CRA corresponding to a Sustainable Data Rate), the Cause "QoS cannot be guaranteed" is used in the Response message, but it should not be interpreted as a reject.			

6.1.4 Channel_ID IE

Table 6.6: Channel_ID IE

Channel IE (0x05)	Size (bits)	Value/Comments
Channel ID	8	Transmission channel as defined in EN 301 790 [1]

6.1.5 Source/Destination address IEs

Table 6.7: Source/Destination Address IEs

Source Address IE (0x06)	Size (bits)	Value/Comments
Source Address Field	48	IPv4 addresses or IP networks or MAC addresses are used by RCSTs and NCC, according to the addressing type. The field is uimsbf encoded (unsigned integer MSB first) - see ISO/IEC 13818-1 (see bibliography).
NOTE: An IP network is represented by CIDR (Classless InterDomain Routing) notation. In CIDR (RFC 1518 and RFC 1519 - see bibliography]) an IP network is represented by a prefix, which is an IP address and some indication of the length of the mask: aa.bb.cc.dd/ee (4 bytes for IPv4 address + 1 for shortened mask value). Length means the number of left-most contiguous mask bits that are set to one. In case of IP addresses (4 bytes) or IP networks (5 bytes), the most significant bytes are unused.		

Destination Address IE (0x07)	Size (bits)	Value/Comments
Destination Address Field	48	IPv4 addresses or IP networks or MAC addresses are used by RCSTs and NCC, according to the addressing type. The field is uimsbf encoded (unsigned integer MSB first) - see ISO/IEC 13818-1 (bibliography).
NOTE: An IP network is represented by CIDR (Classless InterDomain Routing) notation. In CIDR (RFC 1518 and RFC 1519 - see bibliography) an IP network is represented by a prefix, which is an IP address and some indication of the length of the mask: aa.bb.cc.dd/ee (4 bytes for IPv4 address + 1 for shortened mask value). Length means the number of left-most contiguous mask bits that are set to one. In case of IP addresses (4 bytes) or IP networks (5 bytes), the most significant bytes are unused.		

6.1.6 Forward/Return Stream Identifier IEs

Table 6.8: Forward/Return Stream Identifier IEs

Forward Stream Identifier IE (0x08)	Size (bits)	Value/Comments
Reserved	11	PID extension. Default value all "0"
Forward PID	13	Field is uimsbf encoded (unsigned integer MSB first) - see ISO/IEC 13818-1 (see bibliography). PID format shall comply with ITU-T Recommendation H.222.0 [3]

Forward Stream Identifier IE (0x09)	Size (bits)	Value/Comments
Reserved	11	PID extension. Default value all "0"
Return PID	13	Field is uimsbf encoded (unsigned integer MSB first) - see ISO/IEC 13818-1 (see bibliography). PID format shall comply with ITU-T Recommendation H.222.0 [3]

6.1.7 Connection Type IE

Table 6.9: Connection Type IE

Connection type IE (0x0A)	Size (bits)	Value/Code	
Connection type	8	point to point bi-directional Terminal-Initiated	0x01
		point to point bi-directional NCC-Initiated	0x02
		point to point uni-directional Terminal -Initiated	0x03
		point to point uni-directional NCC-Initiated	0x04
		point to multipoint RSGW-Initiated ("star" multicast)	0x05
		point to multipoint RCST-Initiated ("mesh" multicast)	0x06
		point to multipoint NCC-Initiated	0x07
		multipoint to point	0x08
		multipoint to multipoint	0x09
		Reserved	0x0A to 0xFF

6.1.8 Forward/Return profiles IEs

Table 6.10: Forward/Return profiles Ies

Forward/Return profile IE (0x0B/0x0C)	Size (bits)	Value/Comments
Priority/QoS	8	Priority/QoS provides information about: - Priority level: traffic class - QoS mode: additional QoS data
Peak Data Rate	8	coded on one byte as follows: - 1 bit (MSB) defines the Scaling Factor: value "1" represents a Scaling Factor of 16, values "0" represents a Scaling Factor of 1 - 7 bits representing a multiple M of 4 kbps (uimsbf encoded) - the resulting rate D is given by : D = (Scaling Factor) × (M) × 4 kbps
Sustainable Data Rate	8	coded on one byte as follows: - 1 bit (MSB) defines the Scaling Factor: value "1" represents a Scaling Factor of 16, values "0" represents a Scaling Factor of 1 - 7 bits representing a multiple M of 4 kbps (uimsbf encoded) - the resulting rate D is given by : D = (Scaling Factor) × (M) × 4 kbps
NOTE 1: Peak Data Rate (PDR) and Sustainable Data Rate (SDR) parameters are mapped into GCR (Guaranteed Constant Rate) and UVR (Unguaranteed Variable Rate) parameters as follows: - Sustainable Data Rate (SDR) = GCR - Peak Data Rate (PDR) – Sustainable Data Rate (SDR) = UVR NOTE 2: For channel modify C2P message profiles, priority field shall be ignored.		

Table 6.11: Forward/Return profiles Ies QoS Mode and Priority

Priority/QoS	Size (bits)	Value/Code	
QoS Mode	5 bits uimsbf	Additional QoS data	
Priority	3 bits uimsbf	Low Priority (LP)	0x00
		High Priority (HP)	0x01
		High Priority with jitter contraints (HPj)	0x02
		Streaming Priority (StrP)	0x03

6.2 NCC to RCST messages

6.2.1 TIMu format

As defined in EN 301 790 [1], C2P messages sent from NCC to RCSTs use the Connection_Control_descriptor recalled hereafter, using the same IE description as specified in EN 301 790 [1].

Table 6.12:TIMu format

Syntax	No. of bits	
	Reserved	Information
Connection_control_descriptor (){		
Descriptor_tag		8
Descriptor_length		8
Message_header_IE_flag		1
Cause_IE_flag		1
Channel_ID_IE_flag		1
Source_address_IE_flag		1
Destination_address_IE_flag		1
Forward_stream_identifier_IE_flag		1
Return_stream_identifier_IE_flag		1
Connection_type_IE_flag		1
Forward_profile_IE_flag		1
Return_profile_IE_flag		1
Route_IE_flag		1
Main_Key_Exchange_IE_flag		1
Explicit_Key_ Exchange_IE_flag		1
Quick_Key_ Exchange_IE_flag		1
Reserved	2	
If (Message_header_IE_flag == 1)		
Message_Description		8
Message_Length		8
Connection_reference		16
}		
If (Cause_IE_flag == 1) {		
Cause		16
}		
If (Route_IE_flag == 1) {		
Route_ID		16
}		
If (Channel_ID_IE_flag == 1) {		
Channel_ID		8
}		
If (Source_address_IE_flag == 1) {		
Source_address_loop_count		8
For (i=0;i<=Source_address_loop_count;i++) {		
Source_Address }		48
}		
If (Destination_address_IE_flag == 1) {		
Destination_address_loop_count		8
For (i=0;i<=Destination_address_loop_count;i++) {		
Destination_Address}		48
}		
If (Forward_stream_identifier_IE_flag == 1) {		
Forward_stream_identifier		24
}		
If (Return_stream_identifier_IE_flag == 1) {		
Return_stream_identifier		24
}		
If (Connection_type_IE_flag == 1) {		
Connection_type		8
}		

Syntax	No. of bits	
	Reserved	Information
If (Forward_profile_IE_flag == 1) {		
Forward_profile		24
}		
If (Return_profile_IE_flag == 1) {		
Return_profile		24
}		
If (Main_Key_Exchange_IE_Flag == 1){		
Main_Key_Exchange		48+Pns+3*Ppka
}		
If (Quick_Key_Exchange_IE_Flag = = 1) {		
Quick_Key_Exchange		48+Pns
} If (Explicit_Key_Exchange_IE_Flag = = 1) {		
Explicit_Key_Exchange		56+Pns+Pea
}		

- descriptor_tag: The descriptor tag is an 8 bit field which identifies each descriptor. Its value is given in the Tag value column of table 51.
- descriptor_length: The descriptor length is an 8 bit field specifying the number of bytes of the descriptor immediately following the descriptor_length field.
- message_body: target This variable length field shall contain a C2P signalling message for passing to the connection control entity. Its length shall not exceed 255 bytes and it is likely to limit it so that related section fits into a single TS packet. As defined in previous section, message_length corresponds to the full message body (starting from message_description).

NOTE: The values Pns, Ppka and Pea will depend on the security implementation done following last version of EN 301 790 [1].

7 Connection control messages

7.1 Point-to-point connection establishment messages

7.1.1 CnxEstReq (Connection Establishment Request) Unicast

7.1.1.1 CnxEstReq RCST initiated unicast connection

7.1.1.1.1 From calling RCST to NCC (DULM)

Table 7.1: Unicast CnxEstReq Fields RCST initiated: calling RCST to NCC

Fields		calling RCST to NCC	Value/Comments	
Message header	message type	X	"0x0C"	"00001" see clause 6.1.2
	addressing type			"100"
	Length	X	C2P message length	
	Connection ref	X	Calling RCST selected connection reference id	
Cause				
Channel_ID				
Source Address		X	Source IPv4 address of the IP datagram triggering the connection	
Destination Address		X	Destination IPv4 address of the IP datagram triggering the connection	
Forward Stream Identifier				
Return Stream Identifier				

Fields	calling RCST to NCC	Value/Comments
Connection Type	X	"0x01" point to point bi-directional Terminal-Initiated or "0x03" point to point uni-directional Terminal-Initiated
Forward Profile	X	Reception parameters filled by the calling RCST with C2P parameters after multifield IP flow classification
Return Profile	X	Transmission parameters filled by the calling RCST with C2P parameters after multifield IP flow classification
NOTE: Only the corresponding fwd or rtn profile will be present in case of unidirectional connections.		

7.1.1.1.2 From NCC to called RCST (TIM)

Table 7.2: Unicast CnxEstReq Fields RCST initiated: NCC to called RCST

Fields		NCC to called RCST	Value/Comments	
Message header	message type	X	"0xE" or "0xA"	"00001" see clause 6.1.2
	addressing type			"110" or "010"
	Length	X	C2P message length	
	Connection ref	X	NCC selected connection reference id to identify the second half of the connection (towards the Called RCST)	
Cause				
Channel_ID		X	New or an already existing Channel_ID	
Source Address		X	calling RCST MAC address	
Destination Address		X	destination address includes the calling RCST IP subnet mask or list of IP subnet masks	
Forward Stream Identifier		X	PID assigned to connection Forward path	
Return Stream Identifier		X	PID assigned to connection Return path	
Connection Type		X	"0x01" point to point bi-directional Terminal-Initiated or "0x03" point to point uni-directional Terminal-Initiated	
Forward Profile		X	Reception parameters filled by the calling RCST and formatted by the NCC	
Return Profile		X	Transmission parameters filled by the calling RCST and formatted by the NCC	
NOTE 1: Only the corresponding fwd or rtn stream_ID and profile will be present in case of unidirectional connections. NOTE 2: Rx and Tx values are swapped by NCC to match the called RCST point of view.				

7.1.1.2 CnxEstReq NCC initiated unicast connection

Table 7.3: Unicast CnxEstReq Fields NCC initiated: Initiating NCC to RCST

Fields		Initiating NCC to RCST	Comments	
Message header	message type	X	"0x0F" or "0x0B"	"00001" see clause 6.1.2
	addressing type			"111" or "011"
	Length	X	C2P message length	
	Connection ref	X	NCC selected connection reference id	
Cause				
Channel_ID		X	New dedicated Channel_ID	
Source Address		X	RCST MAC address of the other end	
Destination Address		X	IP subnet mask , or list of IP subnet masks, of the other end RCST	
Forward Stream Identifier		X	PID assigned to connection Forward path	
Return Stream Identifier		X	PID assigned to connection Return path	
Connection Type		X	"0x02" point to point bi-directional NCC-Initiated or "0x04" point to point uni-directional NCC-Initiated	
Forward Profile		X	Reception parameters filled by the NCC	
Return Profile		X	Transmission parameters filled by the NCC	

Fields	Initiating NCC to RCST	Comments
NOTE 1: For NCC initiated connections, both RCSTs are considered as called RCSTs. Each of them will receive a different NCC selected connection reference. NOTE 2: Only the corresponding fwd or rtn stream_ID and profile will be present in case of unidirectional connections.		

7.1.2 CnxEstResp (Connection Establishment Response) Unicast

7.1.2.1 CnxEstResp RCST initiated unicast connection

7.1.2.1.1 From called RCST to NCC (DULM)

Table 7.4: Unicast CnxEstResp Fields RCST initiated: called RCST to NCC

Fields		called RCST to NCC	Comments	
Message header	message type	X	"0x10"	"00010" see clause 6.1.2
	addressing type			"000"
	Length	X	C2P message length	
	Connection ref	X		
Cause		X	It indicates whether the command has been successfully executed or not (error reason) See clause 6.1.3	
Channel_ID				
Source Address		X	MAC address of the calling RCST on satellite interface	
Destination Address		X	IP subnet mask , or list of IP subnet masks, of the RCST	
Forward Stream Identifier				
Return Stream Identifier				
Connection Type		X	"0x01" point to point bi-directional Terminal-Initiated or "0x03" point to point uni-directional Terminal-Initiated	
Forward Profile		X	Reception parameters filled by the NCC	
Return Profile		X	Transmission parameters filled by the NCC	
NOTE 1: In case of a connection response reject message (cause different than success), addressing_type should be 0x05 (No address specified). No address fields will be present in the message. NOTE 2: Fwd and Rtn profiles can be different from the one sent by the NCC if it cannot be supported by the called RCST (for capacity or policy reasons). NOTE 3: Only the corresponding forward or return profile will be present in case of unidirectional connections.				

7.1.2.1.2 From NCC to calling RCST (TIM)

Table 7.5: Unicast CnxEstResp Fields RCST initiated: NCC to calling RCST

Fields		NCC to calling RCST	Comments	
Message header	message type	X	"0x17" or "0x13"	"00010" see clause 6.1.2
	addressing type			"111" or "011"
	Length	X	C2P message length	
	Connection ref	X		
Cause		X	It indicates whether the command has been successfully executed or not (error reason). See clause 6.1.3	
Channel_ID		X	it can be a new or an already existing Channel_ID	
Source Address		X	Called RCST MAC address	
Destination Address		X	Called IP subnet mask , or list of IP subnet masks, of the RCST	
Forward Stream Identifier		X	PID assigned to connection Forward path	
Return Stream Identifier		X	PID assigned to connection Return path	
Connection Type		X	"0x01" point to point bi-directional Terminal-Initiated or	

Fields	NCC to calling RCST	Comments
		"0x03" point to point uni-directional Terminal-Initiated
Forward Profile	X	Reception parameters filled by the NCC
Return Profile	X	Transmission parameters filled by the NCC
NOTE 1: In case of a connection response reject message (cause different than success), addressing_type should be 0x05 (No address specified). No address fields will be present in the message. NOTE 2: Fwd and Rtn profiles can be different from the one sent by the NCC if it cannot be supported by the called RCST (for capacity or policy reasons). NOTE 3: Only the corresponding fwd or rtn stream_ID and profile will be present in case of unidirectional connections.		

7.1.2.2 CnxEstResp NCC initiated unicast connection

Table 7.6: Unicast CnxEstResp Fields NCC initiated: RCST to initiating NCC

Fields		RCST to initiating NCC	Comments	
Message header	message type	X	"0x10"	"00010" see clause 6.1.20
	addressing type			"000"
	Length	X	C2P message length	
	Connection ref	X		
Cause		X	It indicates whether the command has been successfully executed or not (error reason) See clause 6.1.3	
Channel_ID		X	it can be a new or an already existing Channel_ID	
Source Address		X	RCST MAC address	
Destination Address		X	RCST MAC address (the other end of the connection)	
Forward Stream Identifier				
Return Stream Identifier				
Connection Type		X	"0x02" point to point bi-directional NCC-Initiated or "0x04" point to point uni-directional NCC-Initiated	
Forward Profile		X	Reception parameters filled by the NCC	
Return Profile		X	Transmission parameters filled by the NCC	
NOTE 1: For NCC initiated connections, both RCSTs are considered as called RCSTs. NOTE 2: In case of a connection response reject message (cause different than success), addressing_type should be 0x05 (No address specified). No address fields will be present in the message. NOTE 3: Fwd and Rtn profiles can be different from the one sent by the NCC if it cannot be supported by the called RCST (for capacity or policy reasons). NOTE 4: Only the corresponding fwd or rtn profile will be present in case of unidirectional connections.				

7.2 Point-to-multipoint connection establishment messages

7.2.1 CnxEstReq (Connection Establishment Request) Multicast

7.2.1.1 CnxEstReq RSGW initiated star multicast connection

Table 7.7: Multicast CnxEstReq RSGW initiated Fields: Multicast calling RSGW to NCC

Fields		Multicast Calling RSGW to NCC	Comments	
Message header	message type	X	"0x0C"	"00001" see clause 6.1.2
	addressing type			"100" see clause 6.1.2
	length	X	C2P message length	
	Connection ref	X	Calling RSGW selected connection reference id	
Cause				
Channel_ID				
Source Address		X	Source address of the IP multicast packet	
Destination Address		X	Destination address of the IP multicast packet (Multicast IP address of the group)	

Fields	Multicast Calling RSGW to NCC	Comments
Forward Stream Identifier		
Return Stream Identifier		
Connection Type	X	"0x05" point to multipoint RSGW-Initiated ("star multicast")
Forward Profile		
Return Profile	X	Filled by the Source RSGW via multifield IP flow classification
NOTE: In star multicast the source of the multicast traffic is behind the RSGW.		

7.2.1.2 CnxEstReq RCST initiated mesh multicast connection

Table 7.8: Multicast CnxEstReq RCST initiated Fields: Multicast calling RCST to NCC

Fields		Multicast calling RCST to NCC	Comments	
Message header	message type	X	"0x0C"	"00001" See clause 6.1.2
	addressing type			"100"
	Length	X	C2P message length	
	Connection ref	X	Calling RCST selected connection reference id	
Cause				
Channel_ID				
Source Address		X	Source address of the multicast IP packet	
Destination Address		X	Destination address of the multicast IP packet (Multicast IP address of the group)	
Forward Stream Identifier				
Return Stream Identifier				
Connection Type		X	"0x06" point to multipoint RCST-Initiated ("mesh multicast")	
Forward Profile				
Return Profile		X	Filled by the RCST via multifield IP flow classification	
NOTE: In mesh multicast the source of the multicast flow is behind an RCST.				

7.2.1.3 CnxEstReq NCC initiated multicast connection

Table 7.9: Multicast CnxEstReq NCC initiated Fields: Initiating NCC to called RCST or RSGW

Fields		Initiating NCC to called RCST or RSGW	Comments	
Message header	message type	X	"0X0F"	"00001" see clause 6.1.2
	addressing type			"111"
	Length	X	C2P message length	
	Connection ref	X	NCC selected connection reference id	
Cause				
Channel_ID		X	A new Channel_ID	
Source Address		X	multicast (Multicast Src RCST) or broadcast (Multicast Src RSGW) MAC address	
Destination Address		X	Multicast IP address of the group	
Forward Stream Identifier				
Return Stream Identifier		X	Multicast PID	
Connection Type		X	"0x07" Point to multipoint uni-directional NCC-Initiated	
Forward Profile				
Return Profile		X	Filled by the NCC (priority and resources parameters for RCST/RSGW multicast transmission)	
NOTE: Multicast MAC addresses shall be deduced from the group IP address, as defined in RFC 1112 [2]. A NCC initiated multicast could either be mesh or star multicast, depending the source of the multicast flow is behind an RCST or RSGW, in other words, if the message is NCC to called RCST or NCC to called RSGW.				

7.2.2 CnxEstResp (Connection Establishment Response) Multicast

7.2.2.1 CnxEstResp RSGW initiated star multicast connection

Table 7.10: Multicast CnxEstResp RSGW initiated: NCC to calling RSGW

Fields		NCC to calling RSGW	Comments	
Message header	message type	X	"0x11"	"00010" see clause 6.1.2
	addressing type			"001"
	Length	X	C2P message length	
	Connection ref	X	Calling RSGW selected connection reference id	
Cause		X	It indicates whether the command has been successfully executed or not (error reason) See clause 6.1.3	
Channel_ID		X	Can be a new or an already existing Channel_ID	
Source Address		X	Multicast MAC address of the group (RFC 1112 [2])	
Destination Address		X	Multicast IP address of the group	
Forward Stream Identifier				
Return Stream Identifier		X	Multicast PID	
Connection Type		X	"0x05" Point to multipoint RSGW-Initiated ("star multicast")	
Forward Profile				
Return Profile		X	Can be different from the one sent by the RSGW if it could not be supported for capacity or policy reason	

NOTE 1: In case of a connection response reject message (cause different than success), addressing_type should be 0x05 (No address specified). No address fields will be present in the message.
NOTE 2: Only return stream and profile are required as all multicast connection are unidirectionals.
NOTE 3: Rtn profiles can be different from the one sent by the NCC if it cannot be supported due to capacity or policy reasons.
NOTE 4: Multicast MAC addresses shall be deduced from the group IP address, as defined in RFC 1112 [2].

7.2.2.2 CnxEstResp RCST initiated mesh multicast connection

Table 7.11: Multicast CnxEstResp CRST initiated: NCC to calling RCST

Fields		NCC to calling RCST	Comments	
Message header	message type	X	"0x17"	"00010" see clause 6.1.2
	addressing type			"111"
	Length	X	C2P message length	
	Connection ref	X	Calling RCST selected connection reference id	
Cause		X	It indicates whether the command has been successfully executed or not (error reason). See clause 6.1.3	
Channel_ID		X	Can be a new or an already existing Channel_ID	
Source Address		X	Multicast MAC address of the group IP address (RFC 1112 [2])	
Destination Address		X	Multicast IP address of the group	
Forward Stream Identifier				
Return Stream Identifier		X	Multicast PID	
Connection Type		0x06 (mesh)	"0x06" Point to multipoint RSGW-Initiated ("mesh multicast")	
Forward Profile				
Return Profile		X	Can be different from the one sent by the RSGW if it could not be supported for capacity or policy reason	

NOTE 1: In case of a connection response reject message (cause different than success), addressing_type should be 0x05 (No address specified). No address fields will be present in the message.
NOTE 2: Only return stream and return profile are required as all multicast connection are unidirectionals.
NOTE 3: Return profiles can be different from the one sent by the NCC if it cannot be supported due to capacity or policy reasons.
NOTE 4: Multicast MAC addresses shall be deduced from the group IP address, as defined in RFC 1112 [2].

7.2.2.3 CnxEstResp NCC initiated multicast connection

Table 7.12: Multicast CnxEstResp NCC initiated multicast connection: Called RCST to NCC

Fields		RCST or RSGW to Initiating NCC	Comments	
Message header	message type	X	"0x10"	"00010"
	addressing type			"000"
	Length	X	C2P message length	
	Connection ref	X	NCC selected connection reference id	
Cause		X	It indicates whether the command has been successfully executed or not (error reason) See clause 6.1.3	
Channel_ID		X	Can be a new or an already existing Channel_ID	
Source Address		X	RSGW or RCST MAC addresses	
Destination Address		X	multicast MAC or MAC address deduced from the group IP address (RFC 1112 [2])	
Forward Stream Identifier				
Return Stream Identifier		X	Multicast PID	
Connection Type		X	"0x07" Point to multipoint NCC-Initiated	
Forward Profile				
Return Profile		X	Can be different from the one sent by the RSGW if it could not be supported for capacity or policy reason	

NOTE 1: In case of a connection response reject message (cause different than success), addressing_type should be 0x05 (No address specified). No address fields will be present in the message.
NOTE 2: Only return stream and profile are required as all multicast connection are unidirectionals.
NOTE 3: Rtn profiles can be different from the one sent by the NCC if it cannot be supported due to capacity or policy reasons.

7.3 Connection release messages

7.3.1 CnxRelReq (Connection Release Request)

Table 7.13: CnxRelReq Fields

Fields		Calling RCST to NCC	NCC to called RCST	Initiating NCC to RCST	Comments	
Message header	message type	X	X	X	"0x1D"	"00011"
	addressing type					"101"
	length	X	X	X	C2P message length	
	connection ref	X	X	X	Connection reference id	
Cause		X	X	X	It indicates whether the command has been successfully executed or not (error reason) See clause 6.1.3	
Channel_ID			X	X	Channel_ID	
Source Address						
Destination Address						
Forward Stream Identifier						
Return Stream Identifier						
Connection Type						
Forward Profile						
Return Profile						

7.3.2 CnxRelResp (Connection Release Response)

Table 7.14: CnxRelResp Fields

Fields		Calling RCST to NCC	NCC to called RCST	Initiating NCC to RCST	Comments	
Message header	message type	X	X	X	"0x1D"	"00011"
	addressing type					"101"
	length	X	X	X	C2P message length	
	connection ref	X	X	X	Connection reference id	
Cause		X	X	X	It indicates whether the command has been successfully executed or not (error reason) See clause 6.1.3	
Channel_ID						
Source Address						
Destination Address						
Forward Stream Identifier						
Return Stream Identifier						
Connection Type						
Forward Profile						
Return Profile						

7.4 Connection Modify messages

7.4.1 CnxModifyReq Profile (Connection Modify Request)

7.4.1.1 From calling RCST to NCC (DULM)

Table 7.15: CnxModReq/Profile/Join/Leave Fields

Fields		Calling RCST to NCC	Comments	
Message header	message type	X	"0x2C"	"00101"
	addressing type			"100"
	length	X	C2P message length	
	connection ref	X	Connection rerefence id	
Cause				
Channel_ID		X		
Source Address		X		
Destination Address		X		
Forward Stream Identifier		X		
Return Stream Identifier		X		
Connection Type		X		
Forward Profile		X		
Return Profile		X		
NOTE: This message can be either used to modify Forward and/or Return Profiles of the connection.				

7.4.1.2 From NCC to called RCST to NCC (TIM)

Table 7.16: CnxModReq/Profile/Join/Leave Fields

Fields		NCC to called RCST	Comments	
Message header	message type	X	"0x28"	"00101"
	addressing type			"000"
	length	X	C2P message length	
	connection ref	X	Connection reference id	
Cause				
Channel_ID		X		
Source Address		X		

Fields	NCC to called RCST	Comments
Destination Address	X	
Forward Stream Identifier	X	
Return Stream Identifier	X	
Connection Type	X	
Forward Profile	X	
Return Profile	X	
NOTE: This message can be either used to modify Forward and/or Return Profiles of the connection.		

7.4.2 CnxModifyResp Profile (Connection Modify Response)

Table 7.17: CnxModifyResp/Profile/Join/Leave Fields

Fields		Called RCST to NCC	NCC to calling RCST	Comments	
Message header	message type	X	X	Join "0x39" Leave "0x49"	Join "00111" Leave "01001"
	addressing type				"001"
	length	X	X	C2P message length	
	connection ref	X	X	Connection reference id of the modified connection	
Cause		X	X	It indicates whether the command has been successfully executed or not (error reason)	
Channel_ID		X	X		
Source Address		X	X		
Destination Address		X	X		
Forward Stream Identifier		X	X		
Return Stream Identifier		X	X		
Connection Type		X	X		
Forward Profile		X	X		
Return Profile		X	X		
NOTE: This message can be either used to modify Forward and/or Return Profiles of the connection.					

7.4.3 CnxModifyReq Join (Connection Modify Request)

Table 7.18: CnxModReq Join Fields

Fields		Calling RCST to NCC	NCC to called RCST	Comments	
Message header	message type	X	X	Join "0x39" Leave "0x49"	Join "00111" Leave "01001"
	addressing type				"001"
	length	X	X	C2P message length	
	connection ref	X	X	RCST selected connection reference	
Cause					
Channel_ID					
Source Address		X	X	RCST MAC address	
Destination Address		X	X	IP multicast session that the RCSTwants to join or leave	
Forward Stream Identifier					
Return Stream Identifier					
Connection Type		X	X		
Forward Profile		X	X		
Return Profile		X	X		
NOTE: This message is used to JOIN a multicast session adding the RCST to an existing multicast session and to request the corresponding PID to be decoded.					

Table 7.19: CnxModReq Join Fields

Fields		Calling RCST to NCC	NCC to called RCST	Comments	
Message header	message type	X	X	Join "0x39" Leave "0x49"	Join "00111" Leave "01001"
	addressing type				"001"
	length	X	X	C2P message length	
	connection ref	X	X	RCST selected connection reference	
Cause					
Channel_ID					
Source Address		X	X	RCST MAC address	
Destination Address		X	X	Multicast IP address of the group	
Forward Stream Identifier					
Return Stream Identifier					
Connection Type		X	X		
Forward Profile		X	X		
Return Profile		X	X		
NOTE: This message is used to JOIN a multicast session adding the RCST to an existing multicast session and to request the corresponding PID to be decoded.					

7.4.4 CnxModifyResp Join (Connection Modify Response)

Table 7.20: CnxModifyResp Join Fields

Fields		Called RCST to NCC	NCC to calling RCST	Comments	
Message header	message type	X	X	Join "0x3F"	Join "00111""
	addressing type				"111"
	length	X	X	C2P message length	
	connection ref	X	X	RCST selected connection reference id	
Cause		X	X	it indicates whether the command has been successfully executed or not (error reason)	
Channel_ID					
Source Address		X	X	Multicast MAC address of the group IP address (RFC 1112 [2])	
Destination Address		X	X	Multicast IP address of the group	
Forward Stream Identifier		X	X	PID value to decode the multicast session	
Return Stream Identifier					
Connection Type		X	X		
Forward Profile					
Return Profile					
NOTE: This message is used to JOIN a multicast session adding the RCST to an existing multicast session and to request the corresponding PID to be decoded.					

7.4.5 CnxModifyReq Leave (Connection Modify Request)

Table 7.21: CnxModReq Leave Fields

Fields		Calling RCST to NCC	NCC to called RCST	Comments	
Message header	message type	X	X	"0x4F"	"01001"
	addressing type				"001"
	length	X	X	C2P message length	
	connection ref	X	X	RCST selected connection reference	
Cause					
Channel_ID					
Source Address		X	X	RCST MAC address	
Destination Address		X	X	Multicast IP address of the group	
Forward Stream Identifier					

Fields	Calling RCST to NCC	NCC to called RCST	Comments
Return Stream Identifier			
Connection Type	X	X	
Forward Profile	X	X	
Return Profile	X	X	
NOTE: This message is used to LEAVE a multicast session, to remove an RCST to an existing multicast session.			

7.4.6 CnxModifyResp Leave (Connection Modify Response)

Table 7.22: CnxModifyResp Leave Fields

Fields		called RCST to NCC	NCC to calling RCST	Comments	
Message header	message type	X	X	"0x4F"	"01001"
	addressing type				"111"
	length	X	X	C2P message length	
	connection ref	X	X	RCST selected connection reference id	
Cause		X	X	It indicates whether the command has been successfully executed or not (error reason)	
Channel_ID					
Source Address		X	X	Multicast MAC address of the group IP address (RFC 1112 [2])	
Destination Address		X	X	Multicast IP address of the group	
Forward Stream Identifier					
Return Stream Identifier					
Connection Type		X	X		
Forward Profile					
Return Profile					
NOTE: This message is used to LEAVE a multicast session, to remove an RCST to an existing multicast session.					

7.5 Channel modify messages

7.5.1 ChnModifyReq (Channel Modify Request)

Table 7.23: Channel Modify Req Fields

Fields		calling RCST to NCC	NCC to called RCST	Comments	
Message header	message type	X	X	"0x5D"	"01011"
	addressing type				"101"
	length	X	X	C2P message length	
	connection ref	X	X	Value to be ignored (all "0")	
Cause					
Channel_ID		X	X	Identifies the channel whose bandwidth is going to be modified	
Source Address					
Destination Address					
Forward Stream Identifier					
Return Stream Identifier					
Connection Type					
Forward Profile					
Return Profile		X	X	The amount of requested bandwidth for transmission	
NOTE: The requested bandwidth value is a positive number set by the RCST as a multiple of the certain BW step. This requested additional BW value is an absolute amount of BW steps above the already assigned bandwidth shared between all the connections mapped on the same channel, and below a certain maximum BW per channel.					

7.5.2 ChnModifyResp (Channel Modify Response)

Table 7.24: ChnModifyResp Fields

Fields		calling RCST to NCC	NCC to called RCST	Comments	
Message header	message type	X	X	"0x2D"	"00101"
	addressing type				"101"
	length	X	X	C2P message length	
	connection ref	X	X	Value to be ignored (all "0")	
Cause		X	X	it indicates whether the command has been successfully executed or not (error reason)	
Channel_ID		X	X	Identifies the channel whose bandwidth is going to be modified	
Source Address					
Destination Address					
Forward Stream Identifier					
Return Stream Identifier					
Connection Type					
Forward Profile					
Return Profile		X	X	the amount of requested bandwidth for transmission	
NOTE: The requested bandwidth value is a positive number set by the RCST as a multiple of the certain BW step. This requested additional BW value is an absolute amount of BW steps above the already assigned bandwidth shared between all the connections mapped on the same channel, and below a certain maximum BW per channel.					

Annex A (informative): C2P Messages exchange example

A.1 Point to point bi-directional RCST initiated connection

This example provides a unicast C2P scenario. The aim of this annex is to provide a detailed description of the messages described in the corresponding section. All the messages involved in the connection establishment are described at bit level.

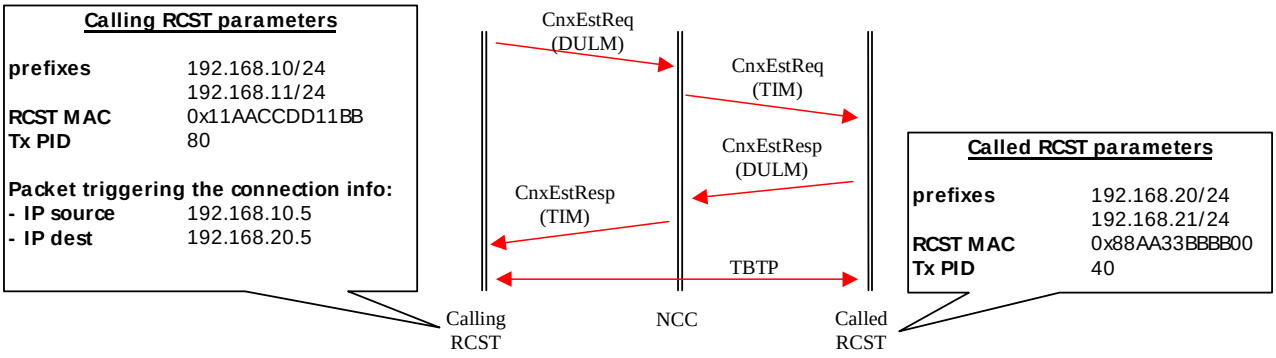


Figure A.1: Point to point bi-directional RCST initiated connection messages example

A.1.1 CnxEstReq calling RCST to NCC

Table A.1: CnxEstReq Calling RCST to NCC

Byte	Message field	Value	Length	Parameter type
0	MPEG-2 Header		32 bits	
4	Group_ID		8 bits	
5	Logon_ID		16 bits	
7	IE Type (1)	0x03	5 bits	Message Header IE
	N/C	0	1 bit	
	F/C	0	1 bit	
	L/C	1	1 bit	
8	IE Length IE (1)	3	8 bits	
9	Message Type	0x01 (CnxEstReq)	5 bits	
	Addressing Type	0x04	3 bits	
10	C2P Message Length	42 – 7 = 35	8 bits	
11	Connection Reference	Set by calling RCST	16 bits	
13	IE Type (2)	0x06	5 bits	Source Address IE
	N/C	0	1 bit	
	F/C	0	1 bit	
	L/C	1	1 bit	
14	IE Length IE (2)	6	8 bits	
15	Source Address	192.168.10.5	48 bits	
21	IE Type (3)	0x07	5 bits	Destination Address IE
	N/C	0	1 bit	
	F/C	0	1 bit	
	L/C	1	1 bit	
22	IE Length IE (3)	6	8 bits	
23	Destination Address	192.168.20.5	48 bits	

Byte	Message field	Value	Length	Parameter type
29	IE Type (4)	0x0A	5 bits	Connection Type IE
	N/C	0	1 bit	
	F/C	0	1 bit	
	L/C	1	1 bit	
30	IE Length IE (4)	1	8 bits	
31	Connection type	0x01 (P-P RCST-Init)	8 bits	
32	IE Type (5)	0x0B	5 bits	Forward Profile IE
	N/C	0	1 bit	
	F/C	0	1 bit	
	L/C	1	1 bit	
33	IE Length IE (5)	3	8 bits	
34	Priority/QoS	PRIO_rx from flow classif.	8 bits	C2P parameters attached to flow type
35	Peak data rate	PDR_rx from flow classif.	8 bits	
36	Sustainable data rate	SDR_rx from flow classif.	8 bits	
37	IE Type (6)	0x0C	5 bits	Return Profile IE
	N/C	0	1 bit	
	F/C	0	1 bit	
	L/C	0	1 bit	
38	IE Length IE (6)	3	8 bits	
39	Priority/QoS	PRIO_tx from flow classif.	8 bits	C2P parameters attached to flow type
40	Peak data rate	PDR_tx from flow classif.	8 bits	
41	Sustainable data rate	SDR_tx from flow classif.	8 bits	
	Padding bytes	*0*		
187	*Padding bytes*	*0*	*8 bits*	

A.1.2 CnxEstReq NCC to called RCST

Table A.2: CnxEstReq NCC to called RCST

Byte	Message field	Value	Length	Parameter type
0	Table_id	B0	8 bits	
1	Section_syntax_indicator	1 (CRC at the end)	1 bit	
	Private_indicator	0 (complement of previous)	1 bit	
	Reserved	*X*	*2 bits*	
	Private Section_length	60 - 3 = 57	12 bits	
3	MAC_address_6	0x88	8 bits	
4	MAC_address_5	0xAA	8 bits	
5	*Reserved*	*X*	*2 bits*	
	Payload_scrambling_ctrl	00	2 bits	TIMu
	Address_scrambling_ctrl	00	2 bits	Header
	LLC_SNAP_flag	0	1 bit	
	Current_next_indicator	1	1 bit	
6	Section_number	0	8 bits	
7	Last_section_number	0	8 bits	
8	MAC_address_4	0x33	8 bits	
9	MAC_address_3	0xBB	8 bits	
10	MAC_address_2	0xBB	8 bits	
11	MAC_address_1	0x00	8 bits	
12	RCST Status	RCST Status (refer to TS 102 429-2 - see bibliography])	8 bits	
13	Descritor_loop_count	0 (1 loop)	8 bits	
14	Descriptor_tag	0xAF (Connection Control Descriptor)	8 bits	
15	Descriptor_length	56 - 16 = 40	8 bits	
16	Message_header_IE_flag	1	1 bit	
	Cause_IE_flag	0	1 bit	
	Channel_IE_flag	1	1 bit	
	Source_address_IE_flag	1	1 bit	
	Destination_address_IE_flag	1	1 bit	
	Forward_stream_identifier_flag	1	1 bit	
	Return_stream_identifier_flag	1	1 bit	
	Connection_type_IE_flag	1	1 bit	
17	Forward_profile_IE_flag	1	1 bit	
	Return_profile_IE_flag	1	1 bit	
	Reserved	*X*	*6 bits*	
18	Message_type	0x01	5 bits uimsbf	Connection
	Addressing_type	0x03 (Dest MAC + list of Dest IP masks)	3 bits	Control
19	Message_Length	56 - 19 = 37	8 bits	Descriptor
20	Connection_reference	Set by calling RCST	16 bits	
22	Channel_ID	Set by NCC	8 bits	
23	Source_address_loop_count	0 (1 loops)	8 bits	
24	Source_address	0x11AACCDD11BB	48 bits	
30	Destination_address_loop_count	1 (2 loops)	8 bits	
31	Destination_address	192.168.10/24	48 bits	
37	Destination_address	192.168.11/24	48 bits	
43	Forward PID	00 00 80	24 bits	
46	Return PID	00 00 40	24 bits	
49	Connection_type	0	8 bits	

Byte	Message field	Value	Length	Parameter type
50	Forward Priority	PRIO_tx of calling RCST	8 bits	NCC forwards C2P parameters requested by the calling RCST while swapping Rx & Tx
51	Forward Peak Data Rate	PDR_tx of calling RCST	8 bits	
52	Forward Sustainable Data Rate	SDR_tx of calling RCST	8 bits	
53	Return Priority	PRIO_rx of calling RCST	8 bits	
54	Return Peak Data Rate	PDR_rx of calling RCST	8 bits	
55	Return Sustainable Data Rate	SDR_rx of calling RCST	8 bits	
56	CRC32		32 bits	

A.1.3 CnxEstResp RCST to NCC

Table A.3: CnxEstResp called RCST to NCC

Byte	Message field	Value	Length	Parameter type
0	Table_id	B0	8 bits	
1	Section_syntax_indicator	1 (CRC at the end)	1 bit	
	Private_indicator	0 (complement of previous)	1 bit	
	Reserved	*X*	*2 bits*	
	Private Section_length	61 - 3 = 58	12 bits	
3	MAC_address_6	0x11	8 bits	
4	MAC_address_5	0xAA	8 bits	
5	*Reserved*	*X*	*2 bits*	
	Payload_scrambling_ctrl	00	2 bits	TIMu Header
	Address_scrambling_ctrl	00	2 bits	
	LLC_SNAP_flag	0	1 bit	
	Current_next_indicator	1	1 bit	
6	Section_number	0	8 bits	
7	Last_section_number	0	8 bits	
8	MAC_address_4	0xCC	8 bits	
9	MAC_address_3	0xDD	8 bits	
10	MAC_address_2	0x11	8 bits	
11	MAC_address_1	0xBB	8 bits	
12	RCST Status	RCST Status (refer to TS 102 429-2 - see bibliography)	8 bits	
13	Descritor_loop_count	0 (1 loop)	8 bits	
14	Descriptor_tag	0xAF (Connection Control Descriptor)	8 bits	
15	Descriptor_length	57 - 16 = 41	8 bits	
16	Message_header_IE_flag	1	1 bit	
	Cause_IE_flag	1	1 bit	
	Channel_IE_flag	1	1 bit	
	Source_address_IE_flag	1	1 bit	
	Destination_address_IE_flag	1	1 bit	
	Forward_stream_identifier_flag	1	1 bit	
	Return_stream_identifier_flag	1	1 bit	
	Connection_type_IE_flag	1	1 bit	
17	Forward_profile_IE_flag	1	1 bit	
	Return_profile_IE_flag	1	1 bit	
	Reserved	*X*	*6 bits*	
18	Message_type	0x01	5 bits uimsbf	Connection Control Descriptor
	Addressing_type	0x07 (Dest MAC + list of Dest IP masks)	3 bits	
19	Message_Length	57 - 19 = 38	8 bits	
20	Connection_reference	Set by calling RCST	16 bits	

Byte	Message field	Value	Length	Parameter type
22	Cause	0x00 (Success)	8 bits	
23	Channel_ID	Set by NCC	8 bits	
24	Source_address_loop_count	0 (1 loops)	8 bits	
25	Source_address	0x88AA33BBBB00	48 bits	
31	Destination_address_loop_count	1 (2 loops)	8 bits	
32	Destination_address	192.168.20/24	48 bits	
3738	Destination_address	192.168.21/24	48 bits	
44	Forward PID	00 00 80	24 bits	
47	Return PID	00 00 40	24 bits	
50	Connection_type	0x01 (P-P RCST-Init)	8 bits	
51	Forward Priority	PRIO_rx of calling RCST	8 bits	NCC forwards C2P parameters replied by the called RCST while swapping Rx & Tx
52	Forward Peak Data Rate	PDR_rx of calling RCST	8 bits	
53	Forward Sustainable Data Rate	SDR_rx of calling RCST	8 bits	
54	Return Priority	PRIO_tx of calling RCST	8 bits	
55	Return Peak Data Rate	PDR_tx of calling RCST	8 bits	
56	Return Sustainable Data Rate	SDR_tx of calling RCST	8 bits	
57	CRC32		32 bits	

A.1.4 CnxEstResp NCC to calling RCST

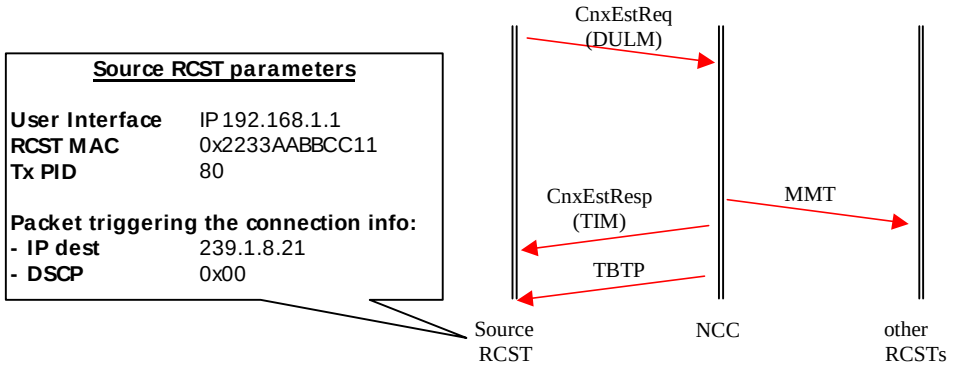
Table A.4: CnxEstResp NCC to calling RCST

Byte	Message field	Value	Length	Parameter type
0	MPEG-2 Header		32 bits	
4	Group_ID		8 bits	
5	Logon_ID		16 bits	
7	IE Type (1)	0x03	5 bits	Message Header IE
	N/C	0	1 bit	
	F/C	0	1 bit	
	L/C	1	1 bit	
8	IE Length IE (1)	3	8 bits	
9	Message Type	0x02 (CnxEstResp)	5 bits	
	Addressing Type	0x00	3 bits	
10	C2P Message Length	45 - 7 = 38	8 bits	
11	Connection Reference	Set by NCC	16 bits	
13	IE Type (1)	0x04	5 bits	Cause IE
	N/C	0	1 bit	
	F/C	0	1 bit	
	L/C	1	1 bit	
14	IE Length IE (1)	1	8 bits	
15	Cause	0x00 (Success)	8 bits	
16	IE Type (2)	0x06	5 bits	Source Address IE
	N/C	0	1 bit	
	F/C	0	1 bit	
	L/C	1	1 bit	
17	IE Length IE (2)	6	8 bits	
18	Source Address	0x11AACCDD11BB	48 bits	
24	IE Type (3)	0x07	5 bits	
	N/C	0	1 bit	

Byte	Message field	Value	Length	Parameter type
	F/C	0	1 bit	Destination Address IE
	L/C	1	1 bit	
25	IE Length IE (3)	6	8 bits	
26	Destination Address	0x88AA33BBBB00	48 bits	
32	IE Type (4)	0x0A	5 bits	Connection Type IE
	N/C	0	1 bit	
	F/C	0	1 bit	
	L/C	1	1 bit	
33	IE Length IE (4)	1	8 bits	
34	Connection type	0x01 (P-P RCST-Init)	8 bits	
35	IE Type (5) = 0x0B		5 bits	Forward Profile IE
	N/C	0	1 bit	
	F/C	0	1 bit	
	L/C	1	1 bit	
36	IE Length IE (5)	3	8 bits	
37	Priority/QoS	PRIO_tx of calling RCST	8 bits	RCST replies with received parameters
38	Peak data rate	PDR_tx of calling RCST	8 bits	
39	Sustainable data rate	SDR_tx of calling RCST	8 bits	
40	IE Type (6)	0x0C	5 bits	Return Profile IE
	N/C	0	1 bit	
	F/C	0	1 bit	
	L/C	0	1 bit	
41	IE Length IE (6)	3	8 bits	
42	Priority/QoS	PRIO_rx of calling RCST	8 bits	RCST replies with received parameters
43	Peak data rate	PDR_rx of calling RCST	8 bits	
44	Sustainable data rate	SDR_rx of calling RCST	8 bits	
	Padding bytes	*0*		
187	*Padding bytes*	*0*	*8 bits*	
NOTE: The value "X" represents a "don't care" value.				

A.2 Point to multipoint uni-directional RCST initiated connection

This example provides a mesh multicast C2P scenario. The aim of this annex is to provide a detailed description of the messages described in the corresponding section. All the messages involved in the connection establishment are described at bit level.



Annex B (informative): Bibliography

- ETSI EN 300 421: "Digital broadcasting systems for television, sound and data services - Framing structure, channel coding and modulation for 11/12 GHz satellite services".
- ETSI TR 101 790: "Digital Video Broadcasting (DVB); Interaction channel for satellite distribution systems; Guidelines for the use of EN 301790".
- ETSI TR 101 202: "Digital Video Broadcasting (DVB); Implementation guidelines for data broadcasting".
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- ETSI TS 102 429-4: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM); Regenerative Satellite Mesh - B (RSM-B); DVB-S/DVB-RCS family for regenerative satellites; Part 4: Specific Management Information Base".
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- IETF RFC 1518: "An Architecture for IP Address Allocation with CIDR".
- IETF RFC 1519: "Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy".

History

Document history		
V1.1.1	October 2006	Publication