SatLabs System Recommendations – Quality of Service Specifications

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Document history

Revision	Date	Changes
1.0	12-06-2008	First version. This document replaces the previous SSR v2 – Part 2: QoS, defined for Version 2.0. It is now an independent document, referenced by both v1.3 and v2.1 SSR. Compared to this previous document, the only change concern the following: - Update of section 5.1.4 with definition of Maximum level of resources requested - AVBDC repetition time is deprecated - ENHCLASSIFIER and RCST_PARA are changed from SatLabs options into technical features that can optionally be tested

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1 References

[1] ETSI EN 301 790 v.1.4.1, “Digital Video Broadcasting (DVB); Interaction channel for satellite distribution systems” (2005-09)

[2] IETF RFC 2475, An Architecture for Differentiated Services, December 1998

[3] IETF RFC 3246, An Expedited Forwarding PHB (Per-Hop Behavior), March 2002

[4] IETF, RFC 2597, Assured Forwarding PHB Group, June 1999

[5] IETF RFC 2474, Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers, December 1998

[6] IETF RFC 3260, New Terminology and Clarifications for Diffserv, April 2002

[7] SatLabs System Recommendations (Version 1.3, Version 2.0 and Version 2.1)

[8] SatLabs System Recommendations: M&C specifications

[9] ETSI TS 102 292, “Satellite Equipment and Systems (SES); Broadband Satellite Multimedia; IP Interworking over Satellite; BSM Functional Architecture”.

[10] ETSI TS 102 462, “Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM) Services and Architectures: QoS Functional Architecture”.

[11] ETSI TR 101 790 v1.3.1, “Digital Video Broadcasting (DVB); Interaction channel for Satellite Distribution Systems; Guidelines for the use of EN 301 790” (2006-09)

[12] IETF RFC 3393, IP Packet Delay Variation Metric for IP Performance Metric (IPPM), November 2002

2 Acronyms

AF	Assured Forwarding
AVBDC	Absolute Volume Based Dynamic Capacity
ATM	Asynchronous Transfer Mode
BE	Best Effort
BoD	Bandwidth on Demand
BSM	Broadband Satellite Multimedia – Ad Hoc working group in ETSI under the SES technical body
CD	Critical Data
CRA	Continuous Rate Assignment
DAMA	Demand Assignment Multiple Access
DS	Differentiated Services (DiffServ)
DSCP	Differentiated Services Code Point
DVB	Digital Video Broadcast
EF	Expedited Forwarding
ETSI	European Telecommunications Standards Institute
FCA	Free Capacity Assignment
IBR	In Band Request
IP	Internet Protocol
MAC	Medium Access Control
MIB	Management Information Base
MPEG	Motion Picture Expert Group
NCC	Network Control Center
OBR	Out of Band Request
PHB	Per Hop Behavior
PID	Packet IDentifier
QoS	Quality of Service
RBDC	Rate Based Dynamic Capacity
RC	Request Class
RCS	Return Channel - Satellite
RCST	Return Channel Satellite Terminal
RT	Real Time
SES	Satellite Earth Stations, ETSI technical body
SLA	Service Level Agreement

TBTP	Terminal Burst Time Plan
TS	Transport Stream
VBDC	Volume Based Dynamic Capacity
VCI	Virtual Channel Identifier
VPI	Virtual Path Identifier
VPN	Virtual Private Network

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3 Introduction

This document forms the QoS specifications part of the SatLabs System Recommendations, defined after Version 1.2 (see [7]). It defines Quality of Service (QoS) architecture and specifications for the return path of a DVB-RCS system.

The focus is on the RCST specifications and requirements, while for the NCC only general guidelines are identified.

Defining such a reference QoS architecture will allow interoperability between the various RCST manufacturers.

The document does not address any QoS issues about the forward path.

General definitions:

For the purposes of the present document, the following terms and definitions apply:

Test System	The test set-up to be used for the SatLabs terminal qualification testing
May, Can	Used to define or describe optional requirements or flexible implementation
Should, Will	Used to define or describe guidelines or preferred implementation
Shall, Must	Used to define or describe mandatory requirements
Recommended	Description of functionality that is recommended to be implemented, but that is either outside the scope of the SatLabs qualification program or describes functionality that is not tested in the SatLabs qualification tests.

Terminology:

A/VBDC designates the combination of VBDC and AVBDC request mechanisms.

RBDC(RT) means RBDC capacity category for the RT Request Class.

The objectives of these QoS specifications are:

- Focus on DVB-RCS MAC layer and shall be consistent with the current version of DVB-RCS standard [1]
- Seek interoperability between different current DVB-RCS systems achieved with minimum modifications to existing implementations
- Seek interoperability with terrestrial networks through consistency with the DiffServ architecture as defined by [2]
- Coordinate with BSM work which tackles interoperability between satellite and other networks and higher layer issues
- Define minimum set of types of DiffServ (DS) Per-Hop Behavior (PHB)’s to be supported
- Recommend the mapping of the PHBs to DVB-RCS capacity requests

4 SatLabs Short-Term return path QoS design

Figure 4-1 shows in a synthetic way a reference protocol stack for the user plane in the context of a DVB-RCS system.

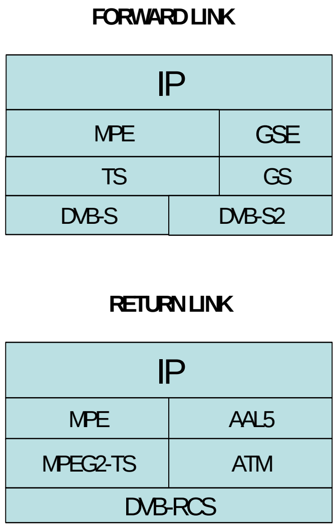

Figure 4-1 - DVB-RCS user plane protocol stack

4.1 DVB-RCS QoS architecture

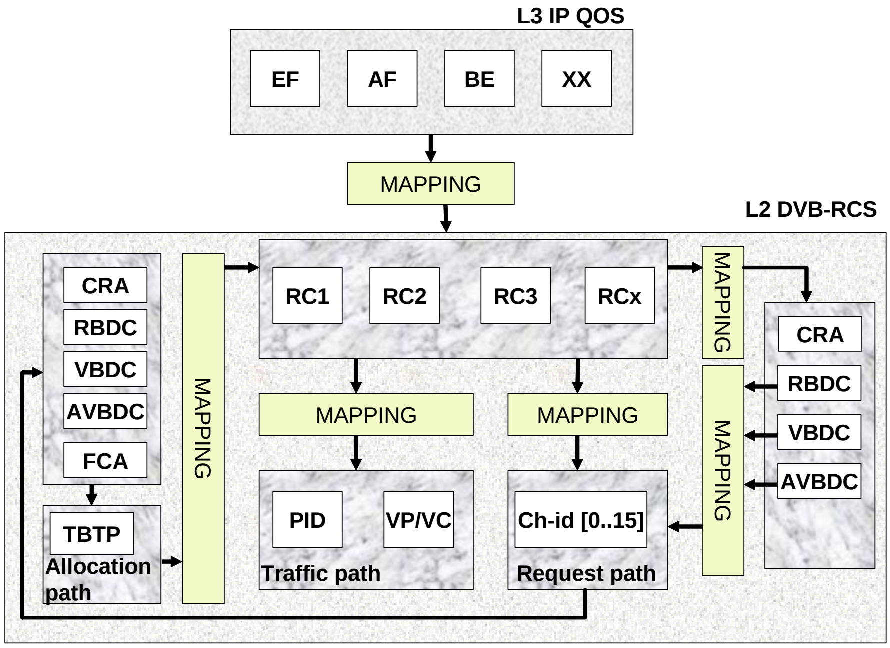

Figure 4-2 – DVB-RCS QoS entities

Figure 4-2 shows the DVB-RCS QoS entities which are discussed in the present document. The overall purpose of this diagram is to identify all the points where configuration is needed (so called mapping in the figure).

This includes mapping between layer 3 IP QoS and layer 2 DVB-RCS and also mapping within layer 2 DVB-RCS between several elements.

To better structure the diagram, three paths are identified, namely the Request path, the Traffic path and the Allocation path.

In the next paragraphs the mapping's rules are described.

4.2 IP Layer QoS

4.2.1 QoS differentiation in a DVB-RCS network

The RCST supports QoS differentiation as described for the DiffServ architecture [2]. In this context the RCST may serve as an interior node in a DiffServ domain or as an edge node of the DS domain. A DS domain is a contiguous set of nodes operating with a common set of service provisioning policies and PHB definitions. This means that each node within the domain operates according to the same PHB specification. A DS domain boundary occurs between nodes where the service provisioning policy or PHB specification is changed going from one node to the other. A DS boundary node can be a node at the boundary between a DS-capable domain and a domain that is not DS-capable or between two different DS domains.

The DVB-RCS network can be regarded as a single DS domain as seen from the user. In this context the RCST is the ingress node on the return link into the DS domain.

RCSTs have to support the following PHBs:

- If ENHQOS option is supported (see [7]): Expedited Forwarding PHB, as defined in [3]
- If ENHQOS option is supported: At least one Assured Forwarding PHB Class (AF3), as defined in [4], with at least two Drop Precedences
- Best Effort PHB, as defined in [5]

RCSTs may be capable of supporting additional PHBs.

The characteristics of the AF PHB Groups are as defined by [4] and have to be specified by the network operator in accordance with the requirements of [4].

We recall here the terminology defined in [6]: each AF Class is an instance of the AF Group type. Therefore [4] defines four AF Groups, not one.

The characteristics of the EF PHB have to be specified by the network operator in accordance with the requirements given in [3].

As a DiffServ node the RCST is capable of mapping packets to the different PHBs supported by the DVB-RCS network. The classifier used to this end should map a packet to the PHB of choice based at least on the DSCP value in the packet header.

In general an RCST will typically support classification based on additional criteria. In particular RCST should also support the following classification criteria:

- IP Protocol Type (only TCP and UDP types are mandatory)
- IP source and destination addresses and masks
- Source and destination ports

The support of these additional criteria can be optionally tested (identified under ENHCLASSIFIER feature in the following).

In order to activate or de-activate classifiers, the PktClassRowStatus parameter of the qos MIB group shall be used (see [8]).

As a DiffServ domain edge node, the RCST is also capable of remarking the DSCP field of packets.

As specified by [5], the RCST must support configurable mapping of the DSCP values of the incoming packets into the supported PHBs.

4.2.2 Cross-domain PHB mapping

A typical mapping of an enterprise PHB portfolio into the DVB-RCS network can be like the one shown in Table 4-1.

Enterprise PHB	**DVB-RCS PHB**
EF	EF
AFn1	AF31
AFn2	AF32
AFn3	AF33
BE	BE

Table 4-1 - Possible inter-DS-domain PHB mapping

Note that the characteristics of the DVB-RCS network will probably dominate the end-to-end services that are built upon EF. This comment may also apply to other PHBs.

The RCST may be capable of supporting several PHBs of the same type. This can be done for various reasons:

- Different services (e.g. Internet access, VPN, Multimedia on Demand…)
- Different subscribers (multi-dwelling arrangements)

4.2.3 Recommended DSCP values for the DVB-RCS PHBs

The DSCP values for the DVB-RCS PHBs are those recommended by the DiffServ standard ([2], [3], [4] and [5]). They are summarized in Table 4-2 for convenience.

DVB-RCS PHB	DSCP
EF	46
AF31	26
AF32	28
AF33	30
BE	0

Table 4-2 - DSCP for the DVB-RCS PHBs

4.2.4 Network QoS performance

The DVB-RCS system can be seen as a particular type of BSM Network as defined in [9]. The contribution of the DVB-RCS segment to the end-to-end QoS support is therefore one of a subnetwork, considered as part of the network IP bearer.

This integrated network environment is described in [10] form which Figure 4-3 is extracted. Each network segment provides its own link layer services. As stated in [10], the QoS provided by the bearer service of each network segment or domain must then be taken into account in the specification of end-to-end IP layer QoS, as indicated in Figure 4-3. This cumulative effect of network segments applies particularly where end-to-end limits on QoS parameters (such as delay, delay variation, packet loss, error rate) are needed.

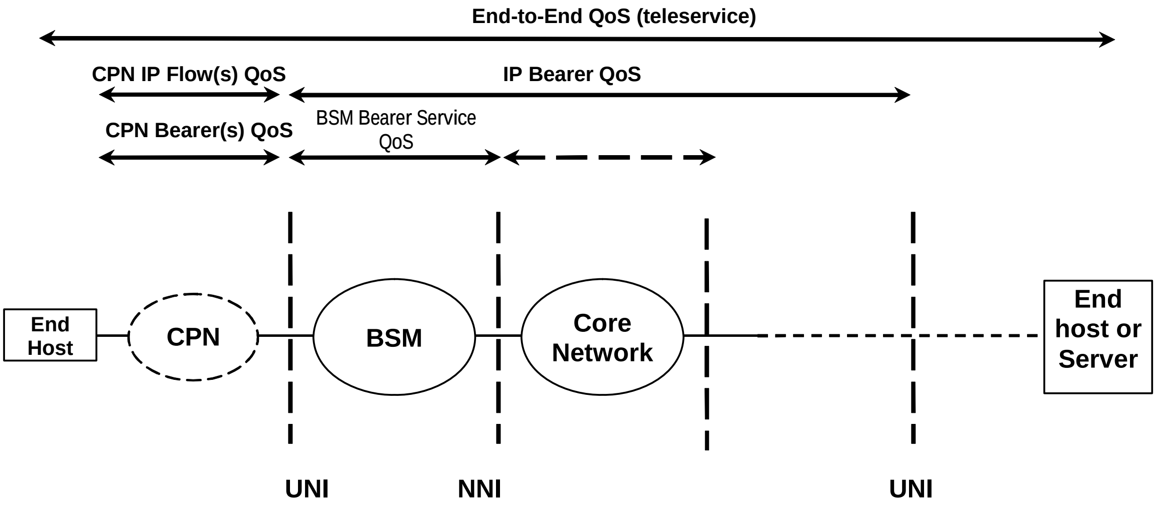

Figure 4-3 - End-to-end QoS and IP QoS and for general IP network scenario

The present section, as the whole document, only specifies this DVB-RCS segment, and more specifically the return link of this segment. Many factors impact the performance of this segment: RCST, NCC, capacity provisioning.

In particular, RCST packet dispatching delay and delay jitter is affected by the RCST performance, the traffic load on the RCST and the NCC slot assignment.

The NCC slot assignment is itself affected by the NCC performance, the assignment policy applied for the RCST, the resource provisioning, the dynamic demand load on the NCC, the demand congestion policy applied by the NCC and the sufficiency of the dynamic demand expressed by the RCST.

The return link performance depicted in Table 4-3 can be considered as a reasonable example of a deployed system. Such performance figures may be given by system manufacturers to their customers. RCST manufactures will be requires to provide more detailed data, focused on the RCST performance. This will be described in section 5.2.

<table>
<tr><th rowspan="2">PHB</th><th colspan="2">Delay</th><th colspan="2">Jitter</th><th rowspan="2">Priority</th><th colspan="2">Bandwidth</th><th colspan="2">Packet loss ratio</th></tr>
<tr><th>Nominal</th><th>Over-load</th><th>Nominal</th><th>Over-load</th><th>Nominal</th><th>Over-load</th><th>Nominal</th><th>Over-load</th></tr>
<tr><td rowspan="2">EF</td><td colspan="2">Sufficiently low (no overbooking)</td><td colspan="2">Minimum possible</td><td rowspan="2"></td><td colspan="2">Given in full during session, when admitted</td><td colspan="2"></td></tr>
<tr><td>300 ms</td><td></td><td>50-100 ms</td><td></td><td></td><td></td><td>< 0.1%</td><td></td></tr>
<tr><td rowspan="2">AF31 /AF32</td><td colspan="2">As good as possible</td><td colspan="2"></td><td rowspan="2">High</td><td colspan="2">In contract</td><td colspan="2"></td></tr>
<tr><td>850 ms</td><td>larger for out of profile traffic</td><td></td><td></td><td></td><td></td><td>< 0.1%</td><td></td></tr>
<tr><td rowspan="2">BE</td><td colspan="2">Not controlled</td><td colspan="2">Not controlled</td><td rowspan="2">Low</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>850 ms</td><td>larger for out of profile traffic</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Table 4-3 - QoS performance figures perceived as a reasonable example of a deployed DVB-RCS network.

4.3 MAC layer QoS

MAC layer QoS support consists in capacity request calculation/generation and scheduling/dispatching of packets from the supported queues to fill-up the assignments in TBTP.

4.3.1 DVB-RCS Request classes

4.3.1.1 Request Classes and PHB

A Request Class (RC) is a representation of a PHB at the MAC layer (in the DAMA Controller). It defines a behavior of the MAC layer for a given aggregation of traffic. This behavior includes a combination of Capacity Categories associated to the RC and a Priority with respect to the other RCs supported by a RCST. As an example, an RCST can have two RCs using VBDC only: one has a priority over the other.

An RC is a concept similar to the PHB, but seen from layer 2. An RC can be seen as part of a PHB instantiation, since it will strongly influence the traffic forwarding.

The RCST maps each PHB onto an RC and it shall be possible to map any PHB to any RC. In general, several PHBs can be mapped to a same RC. Such a generic mapping is illustrated in Figure 4-4, which shows how several PHBs can get their demand aggregated and expressed as demand of a common RC. Several RCs can be served by a common Assignment Policy, as applicable.

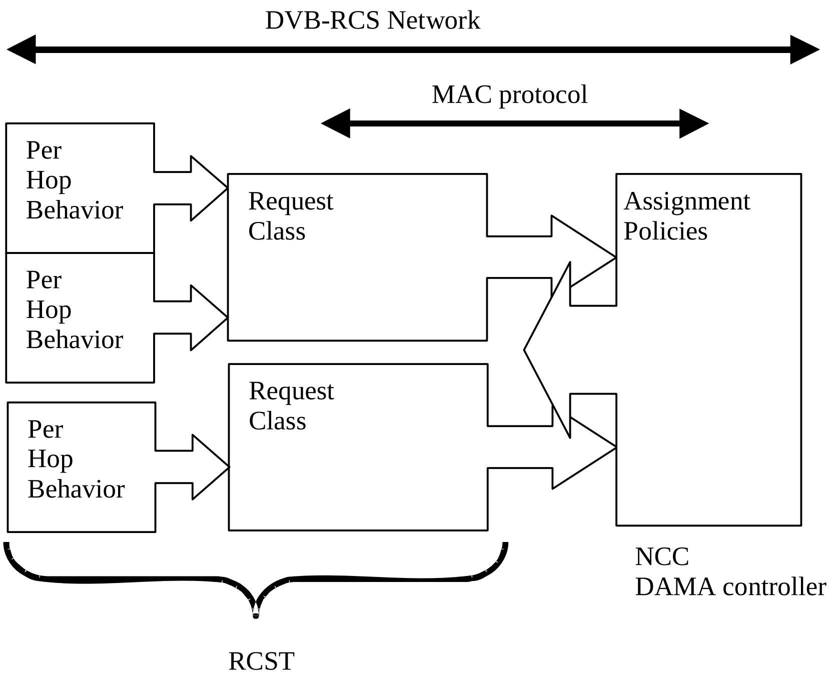

Figure 4-4 - Aggregation of demand related to classification of traffic.

RCST has to support one RC per PHB with the following associations:

- If ENHQOS option is supported: EF PHB is mapped to the Real-Time (RT) RC
- If ENHQOS option is supported: AF PHBs are mapped to the Critical Data (CD) RC
- BE PHB is mapped to the Best Effort (BE) RC

The RCST may be capable of supporting additional PHBs and RCs.

For the purpose of SatLabs testing, the relationship between PHBs and RCs is specified in Table 4-4:

DVB-RCS PHB	DVB-RCS RC (MAC)
EF	Real Time
AF31	Critical Data
AF32	Critical Data
AF33	Critical Data
BE	Best Effort

Table 4-4 – PHB to RC mapping

The NCC shall explicitly instruct the RCST of which RC shall be used for each PHB, by assigning a corresponding RC to each of these PHBs. The RCST management parameters allowing such configuration are defined in 5.3
This mapping configuration shall be supported in consistency with the HM&C specification.

HM&C specification may, in the future, define mechanisms for setting some configuration parameters for the request system dynamically. For short-term QoS, these parameters are fixed for the duration of the RCST session (log-on to log-off). The configuration parameters are non-volatile and persistent so that the RCST will apply the parameter values used in the previous logon session if new values are not given.

4.3.1.2 Request Classes and Capacity Categories

Each RC can support any mix of Capacity Categories.
One of three different sets of request options can be authorized for each RC:

- RBDC
- A/VBDC
- RBDC and (A/VBDC)

CRA and FCA can be combined with any of the above.

If NCC authorized the volume based capacity category, it will offer AVBDC and VBDC in combination, to an RCST or an RC. The combination of AVBDC and VBDC is seen as a single Capacity Category, denoted A/VBDC.

The Capacity Categories CRA, RBDC and A/VBDC, when authorized for a RC, have to be configured from the NCC. These configuration parameters are used to inform the RCST of the configuration of each Category at the NCC side and thus help in Capacity Requests computation.

These parameters are defined in section 4.3.2 for each Capacity Category. The configuration of these parameters is done per RC.

Their configuration may also be possible at RCST level in addition to the configuration per RC. This feature can optionally be tested (identified under RCST_PARA feature in the following).

4.3.1.3 Request Classes and Channel_ID

Each Request Class is identified by a unique Channel_ID in the communication between the RCST and the NCC. Each capacity request will be issued with a reference to the corresponding RC in the Channel_ID field. The Demand Assignment Multiple Access (DAMA) Controller should use this RC indication to associate the requests with the capacity assignment policy applicable to this RC.

Several requests of the same category may be generated by an RCST, one per RC. For the mandatory RCs, these are denoted: RBDC(RT), A/VBDC(RT), RBDC(CD), A/VBDC(CD), RBDC(BE), A/VBDC(BE).

4.3.1.4 Request Classes and VPI/VCI or PID

One or multiple RCs can be mapped to one VPI/VCI or PID.

If ENHQOS option is supported: RCST shall support at least 2 connections (VPI/VCI or PID). At least one of these connections shall be dedicated to RT traffic only.

For MPEG profile several RCs may be mapped within a pool of several PIDs to allow cross RC Section Packing.

Section packing can be used on all PIDs and higher priority traffic can always pre-empt lower priority streams. This will reduce the need for padding.

4.3.2 Capacity categories

4.3.2.1 Capacity requests

4.3.2.1.1 Generalities

The RCST may use different capacity request categories for the different RCs, as authorized by the NCC. The NCC explicitly authorizes which dynamic capacity request categories may be used for each RCs.

The NCC can authorize the RCST to request for bandwidth, in addition to CRA, by use of any of the capacity categories RBDC, VBDC and AVBDC. This authorization is given separately for each RC. The RCST shall refrain from using a capacity category for an RC for which it is not explicitly authorized by the NCC.

When the NCC authorizes more than one capacity request category (RBDC and A/VBDC) for an RC (BE, CD and RT), the RCST will at least request with one of those. When the NCC authorizes exactly one capacity request category (RBDC or A/VBDC) for an RC (BE, CD and RT), the RCST will request with this specific one.

4.3.2.1.2 Computation of capacity requests

Within an RC the RCST must subtract the CRA from capacity requests (RBDC and A/VBDC if applicable).

RCST should as much as possible subtract remaining CRA from capacity requests across RCs.

The RBDC request level indicates the RBDC demand of the associated RC traffic.

The A/VBDC request level indicates the A/VBDC demand of the associated RC traffic.

4.3.2.1.3 Signaling of capacity requests

The RCST assumes that requests opportunities are sufficient to cope with RC performance objectives.

The RCST implements its own policy to issue capacity requests within the available opportunities.

4.3.2.2 Continuous Rate Assignment

Continuous Rate Assignment (CRA) is defined as follows:

- Allocated as a static rate, hence not subject to dynamic requests
- Allocated in full every superframe, whether the RCST has traffic to transmit or not
- The rate is in bit/s (and not in number of slots per superframe), i.e. channel rate available for full ATM cells or MPEG TS packets as applicable
- Allocated to an RCST at logon
- No overbooking is performed at NCC for the DAMA operation: the associated capacity is reserved for the whole duration of the commitment (e.g. at RCST connection level)

If ENHQOS option is not supported: CRA must be supported at least by the BE Class. Any unused CRA from a RC should be re-used by other classes.

If ENHQOS option is supported: CRA must be supported at least by the RT Class. Any unused CRA from a RC should be re-used by other classes.

The CRA parameters are denoted as follows and are expressed in bps:

- *CRA_RT* is the CRA for the RT RC
- *CRA_CD* is the CRA for the CD RC
- *CRA_BE* is the CRA for the BE RC

4.3.2.3 Rate-Based Dynamic Capacity

Rate Based Dynamic Capacity (RBDC) is defined as follows:

- Requests made in kbit/s (in units of 2 or 32 kbit/s depending on the scaling factor as defined in [1]), i.e. it is rate capacity
- Requests are absolute and invalidate previous RBDC requests issued by the RCST
- Similar to CRA, but dynamic in nature (based on requests)
- Guaranteed if not overbooked (up to *RBDCmax*)
- When overbooked, a fair sharing may be applied
- *RBDCmax* is the maximum RBDC rate the RCST can request
- *RBDCmax* is expressed in units of 2 kbit/s
- *RBDCtimeOut* is the time for which an RBDC request is valid, i.e. it is the persistence of an RBDC request received at the NCC
- *RBDCtimeOut* is expressed in superframes
- *RBDCmax* and *RBDCtimeOut* configuration parameters at RC level are mandatory
- *RBDCmax* configuration parameter at RCST level is optional (RCST_PARA feature) and is denoted *RBDCmax_RCST*

4.3.2.4 Volume-Based Dynamic Capacity

Volume Based Dynamic Capacity (VBDC) is defined as follows:

- VBDC requests are in payload units (one ATM cell or one MPEG packet) or 16 payload units depending on the scaling factor as defined in [1]
- VBDC requests are cumulative

"Cumulative" means that the RCST issues VBDC requests that are expected to be accrued at the NCC to previous VBDC or AVBDC requests.

VBDC parameters and the related behavior at RCST level and per RC are as follows:

- *VBDCmax*: Maximum number of payload units per superframe allocated to the RCST or RC through A/VBDC. This is not necessarily an absolute value for each superframe, i.e. it can be an average over several superframes.
- *VBDCmaxBacklog*: Indicates the absolute ceiling of A/VBDC backlog of requested traffic at the NCC.
- *VBDCmaxBacklog* is expressed in bytes.
- *VBDCtimeOut:* Represents the VBDC backlog persistence limit at the NCC.
- *VBDCtimeOut* is reset at the RCST when an A/VBDC request is sent. If the latest A/VBDC request has not been fully served when *VBDCtimeOut* expires, the RCST **shall** consider that none of the pending requests will be served. The RCST **may** then issue a new request for the remaining traffic. This request **shall** be an AVBDC request.
- *VBDCtimeOut* is expressed in superframes.
- *VBDCmax*, *VBDCmaxBacklog* and *VBDCtimeOut* are configured at RC level

- *VBDCmax* and *VBDCmaxBacklog* can be configured at RCST level, when RCST_PARA feature is supported, and are denoted *VBDCmax_RCST* and *VBDCmaxBacklog_RCST*.

Any AVBDC and VBDC request for the respective RC is implicitly interpreted as a *VBDCtimeOut* timer reset.
RCST **may** use *VBDCmax* and *VBDCmaxBacklog* in order to limit its A/VBDC requests.
By respecting these limits the RCST will expect to avoid that the NCC drops AVBDC and VBDC capacity requests due to backlog overflow.

4.3.2.5 Absolute Volume Based Dynamic Capacity

Absolute VBDC (AVBDC) is defined as follows:

- AVBDC requests are absolute and, when received at NCC, invalidate previous VBDC or AVBDC requests issued by the RCST
- AVBDC requested volume relates to the VBDC component of the buffer of the associated RC(s) at the RCST.

RCST may send AVBDC request at any time. For example, an AVBDC request may be sent after the NCC indicates that all A/VBDC request queues have been emptied (TBTP flag as defined in [1]).

4.4 Guidelines for Dispatching of packets

The RCST will dispatch packets into the assigned slots in accordance with policies that are suitable to the PHB that each packet belongs to. This makes the RCST capable of sufficiently exploiting the assigned capacity. Such dispatching is done in a manner that makes the RCST comply with its PHB performance specification (Whatever the Super frame duration).

The RCST does not require RC association of the slots in the TBTP. It is capable of handling scheduling and dispatching by local control.
A SatLabs OPTION is defined which allows the NCC to force the RCSTs to strictly follow RC association when signaled through Channel_ID in the TBTP. This option is denoted CHID_STRICT.
For RCSTs implementing this option, the NCC can enable this feature by setting a management parameter, denoted *ChannelIdStrictDispatching*. See [8] for this parameter definition.

Dispatching of packets at the RCST has to be aligned with the PHB requirements.

4.5 RCST parameters list

Parameters	**Unit**	**Applicability**
CRA_RT	bit/s	X
CRA_CD	bit/s	X
CRA_BE	bit/s	X
RBDCmax_RCST	N* 2 kb/s	RCST_PARA
RBDCmax_RT	N* 2 kb/s	X
RBDCmax_CD	N* 2 kb/s	X
RBDCmax_BE	N* 2 kb/s	X
RBDCtimeOut_RT	superframes	X
RBDCtimeOut_CD	superframes	X
RBDCtimeOut_BE	superframes	X
VBDCmax_RCST	Payloads/SF	RCST_PARA
VBDCmax_RT	Payloads/SF	X
VBDCmax_CD	Payloads/SF	X
VBDCmax_BE	Payloads/SF	X
VBDCmaxBacklog_RCST	bytes	RCST_PARA
VBDCmaxBacklog_RT	bytes	X
VBDCmaxBacklog_CD	bytes	X
VBDCmaxBacklog_BE	bytes	X
VBDCtimeOut_RT	superframes	X
VBDCtimeOut_CD	superframes	X
VBDCtimeOut_BE	superframes	X
ChannelIdStrictDispatching	Boolean Flag 0 = not enabled 1 = enabled	CHID_STRICT

Table 4-5 – RCST parameters list

X = mandatory,

RCST_PARA = RCST_PARA feature supported

CHID_STRICT = CHID_STRICT option supported

5 RCST requirements

5.1 General

5.1.1 IP layer QoS

RCST MUST comply with [5]. In particular:

- Classification based on DSCP SHALL be supported
- Mapping from DSCP to PHB MUST be configurable
- DSCP re-marking SHALL be supported

If ENHCLASSIFIER feature is supported, RCST MUST support all the following classification criteria:

- IP Protocol Type
- IP source and destination addresses and masks
- Source and destination ports

If ENHQOS option is supported, RCST MUST support both the EF PHB and the AF PHB Group types in addition to the BE PHB.

The RCST MAY support additional PHBs.

If ENHQOS option is supported, RCST SHALL comply with the descriptions for the EF and AF PHB's given in [3] and [4] respectively.

If ENHQOS option is supported, RCST SHALL support the AF3 PHB Class, as defined in [4], with at least two Drop Precedences. RCST MAY support other AF PHB Classes.

The RECOMMENDED mapping from DSCP to PHB is the mapping recommended by [2], [3], [4] and [5].

5.1.2 MAC layer QoS

The Request Class value SHALL be the one associated with the specific PHB as set by the NCC.

The RCST SHALL support a Best Effort (BE) Request Class.

If ENHQOS option is supported, the RCST SHALL be configurable with at least 3 Request Classes: RT, CD and BE.

If ENHQOS option is supported, the RCST SHALL support the association of the RT Class with the EF PHB.

If ENHQOS option is supported, the RCST SHALL support the association of the CD Class with the AF PHB.

The RCST SHALL support the association of the BE Class with the BE PHB.

The RCST MAY support additional RCs.

5.1.3 Capacity categories

For each RC, the RCST SHALL use at least one of the Capacity Request Categories authorized by the NCC (RBDC or A/VBDC).

For each RC, the RCST SHALL be capable of using CRA and FCA Capacity Categories when allocated by the NCC.

If RCST_PARA feature is supported and if the RCST parameters are configured, the RCST SHALL limit instantaneous sum of all requests to these RCST parameters.

5.1.4 Capacity requests

Capacity requests categories are RBDC and A/VBDC.

For each RC, the RCST SHALL use at least one of the capacity requests categories authorized by the NCC.

For each RC, the RCST CANNOT use a capacity request category not authorized by the NCC.

The RCST SHALL support RC differentiation of capacity requests by tagging each capacity request with the association to RC in the Channel-ID field.

The RBDC request level SHALL indicate the RBDC demand of the associated RC traffic and not more than required.

The A/VBDC request level SHALL indicate the A/VBDC demand of the associated RC traffic and not more than required.

For each RC, the sum of RBDC and A/VBDC requests shall represent in average the RC traffic need.

5.1.4.1 Continuous rate assignment

At least one mandatory Request Class SHALL be able to support CRA configuration.

If ENHQOS option is supported, at least the RT Class SHALL be able to support CRA configuration.

Any unused CRA from some RCs SHOULD be re-used by other RCs.

The RCST SHALL consider that CRA is not overbooked by NCC.

If ENHQOS option is supported, the RCST SHALL support the configuration of CRA parameter for the highest priority mandatory RC (RT>CD>BE).
The RCST CAN support the configuration of CRA parameter at the level of other RCs.

Within a RC, the RCST SHALL subtract the CRA from capacity requests.

Across RCs, the RCST SHOULD reduce capacity requests according to the CRA level indicated by the NCC and remaining after satisfying demand of higher precedence.

Across RCs, the RCST SHOULD reduce capacity requests according to the Request Class priority (RT>CD>BE for the mandatory RCs).

5.1.4.2 RBDC

The RCST SHALL consider that RBDC RC requests are absolute at NCC.

The RCST SHALL consider that RBDC RC requests invalidate any previous RBDC RC request issued by the RCST at NCC.

The RCST SHALL consider that RBDC RC requests are guaranteed, if not overbooked.

The RCST SHALL support the configuration of *RBDCmax* parameter at the level of each RC.
The RCST MAY support the configuration of *RBDCmax_RCST* parameter at RCST level (RCST_PARA feature).

The RCST SHALL not request more than *RBDCmax*, at RC level, through RBDC requests.
If RCST_PARA feature is supported and *RBDCmax_RCST* parameter is configured, the RCST SHALL not request more than *RBDCmax_RCST* at RCST level.

The RCST SHALL support the configuration of *RBDCtimeOut* parameter at the level of each RC.

The RCST SHALL assume that each RBDC request applies at the NCC for *RBDCtimeOut* or until it is updated by a new RBDC request.

5.1.4.3 A/VBDC

The RCST SHALL consider that VBDC RC requests issued by the RCST are cumulative at NCC.

The RCST SHALL support the configuration of *VBDCmax* parameter at the level of each RC.
The RCST MAY support the configuration of *VBDCmax_RCST* parameter at RCST level (RCST_PARA feature).

The RCST SHALL consider that the NCC will not allocate more than *VBDCmax* payload units per superframe, at RC level, in response to VBDC or AVBDC requests.
If RCST_PARA feature is supported and *VBDCmax_RCST* parameter is configured, the RCST SHALL consider that the NCC will not allocate more than *VBDCmax_RCST* payload units per superframe at RCST level.

The RCST MAY limit its VBDC or AVBDC requests in order not to request in average, at RC level, more than *VBDCmax* payload units per superframe.
If RCST_PARA feature is supported and *VBDCmax_RCST* parameter is configured, the RCST MAY limit its VBDC or AVBDC requests in order not to request in average, at RCST level, more than *VBDCmax* payload units per superframe.

The RCST SHALL support the configuration of *VBDCtimeOut* parameter at the level of each RC.

The RCST SHALL assume that a VBDC or AVBDC request that has not been served by the NCC before *VBDCtimeOut* will not be served.
In such a case, the RCST MAY then issue a new request for the remaining traffic.
Such a request SHALL be an AVBDC request.

The RCST SHALL support the configuration of *VBDCmaxBacklog* parameter at the level of each RC.
The RCST MAY support the configuration of *VBDCmaxBacklog_RCST* parameter at RCST level (RCST_PARA feature).

The RCST SHALL consider that the NCC deletes the related VBDC backlog when time-out expires.

The RCST MAY limit its VBDC or AVBDC requests in order that the maximal A/VBDC requested traffic in NCC queues, at RC level, does not exceed the *VBDCmaxBacklog*.
If RCST_PARA feature is supported and *VBDCmaxBacklog_RCST* parameter is configured, the RCST MAY limit its VBDC or AVBDC requests in order that the maximal A/VBDC requested traffic in NCC queues, at RCST level, does not exceed the *VBDCmaxBacklog_RCST*.

5.1.4.4 AVBDC

The RCST SHALL consider that AVBDC RC requests are absolute at NCC.

The RCST SHALL consider that AVBDC RC requests invalidate any previous A/VBDC RC request issued by the RCST at NCC.

The RCST MAY send a triggered AVBDC request when the NCC sets the *VBDC_queue_empty* flag to '1' in a BTP:

- Case 1: If the Multiple_channels_flag is set to '0' in the BTP, the RCST MAY send a triggered AVBDC request for all RCs having AVBDC as authorized Capacity Request Category.
- Case 2: If the Multiple_channels_flag is set to '1' in the BTP, the RCST MAY only send a triggered AVBDC request for the associated RC.

5.1.4.5 Maximum level of resources requested

Two conditions are regarded, non-congested and congested. Non-congested conditions are characterized by sufficient and timely resource assignment to ensure that there is not excessive backlog. Congested conditions are characterized by a persistent traffic backlog due to late or insufficient assignment of resources.

All the requests issued in connection with a single traffic session are to be regarded. A traffic session is here defined as a period of continuous packet arrivals. A period of not less than 10 seconds without a packet arrival is assumed to constitute a break between sessions. Within the session, packets are assumed to have an inter-arrival time of less than 3 seconds. Observation of conformance is only relevant for request aggregates from traffic sessions of several tens of seconds. Traffic sessions used to qualify the Best Effort and Critical Data classes should reflect the differences between the typical traffic patterns of HTML page rendering (web browsing) and file transfers. Traffic sessions used to qualify the Real Time class should reflect the typical traffic pattern of VoIP traffic.

An infinite RCST traffic backlog buffer is to be assumed when evaluating the level of an AVBDC request.

The minimum required resources in the MPEG mode are to be calculated as an aggregate number of MPEG TS packets based on section packing of the offered session traffic. The minimum required resources in the ATM mode are to be calculated as the required minimum number of ATM cells needed to transfer the offered session traffic.

If non-zero CRA is indicated, the CRA level is assumed to be set too low to handle the offered session traffic alone.

The maximum resources requested in non-congested conditions shall be:

- $[\text{Sum}(RBDC_n * VP_n) + \text{Sum}(VBDC_m)] <$ Min. resources required for traffic + NR – Session_Duration*CRA
- $(\text{Sum}[VBDC_m]) \leq$ (Min. resources required for traffic + NV) – Session_Duration*CRA

- $AVBDC_k \leq$ (Min. resources required for backlog at $T_k - V_{burst\text{-}payload}$ (if RBDC at T_k>0 or CRA > 0) + NA)

$RBDC_n$ – the n-th RBDC request

VP_n – the validity period of $RBDC_n$, limited by $RBDC_n$ timeout or the time elapsed until the next request ($RBDC_{n+1}$), whichever is less

$AVBDC_k$ – the k-th AVBDC request

T_k – the time that the RCST issued $AVBDC_k$

$V_{burst\text{-}payload}$ – the volume of a burst payload

Session_Duration is the time from the start of the traffic session to the end.

CRA represents the CRA level indicated to the RCST.

The conditional reduction by one burst payload in the AVBDC level following a non-zero RBDC is introduced to avoid requesting RBDC and AVBDC for the same traffic.

NR, NV, and NA represent the resource request overshoot.

The maximum resources requested in congested conditions shall be:

- [Sum($RBDC_n$*VP_n) + Sum($VBDC_m$)] < (Min. resources required for traffic + CR) – Session_Duration*CRA
- (Sum[$VBDC_m$]) $\leq$ (Min. resources required for traffic + CV) – Session_Duration*CRA
- (Sum[$RBDC_n$*VP_n]) < (Min. resources required for traffic + CR + Session_Duration * Backlogaverage/RBDCtimeout) – Session_Duration*CRA
- $AVBDC_k \leq$ (Min. resources required for backlog at $T_k - V_{payload}$ (if RBDC at T_k>0 or CRA > 0) + CA)

CR, CV and CA represent the resource request overshoot.

Table 5-1 specifies the accepted request overshoot for Best Effort and Critical Data traffic. Table 5-2 specifies the accepted request overshoot for Real Time traffic. Request overshoot is to be considered at the aggregate level after completion of a single traffic session.

Parameter	Value for ATM	Value for MPEG
NR	An aggregate of 10% of the minimum resources required	An aggregate of 10% of the minimum resources required

NV	Zero	An aggregate of 10% of the minimum resources required at a regular packet size occupying in average >90% of the burst payload[1]
NA	Zero	Zero
CR	An aggregate of 10% of the minimum resources required	An aggregate of 10% of the minimum resources required
CV	Zero	An aggregate of 1% of the minimum resources required[2]
CA	Zero	Zero

Table 5-1 - Accepted request overshoot for Best Effort traffic and Critical Data traffic under different conditions.

Parameter	**Value for ATM**	**Value for MPEG**
NR	An aggregate of 10% of the minimum resources required assuming <10% packet inter-arrival jitter and ≥ 25 pps	An aggregate of 10% of the minimum resources required assuming <10% packet inter-arrival jitter and ≥ 25 pps
NV	Zero	An aggregate of 10% of the minimum resources required at a regular packet size occupying in average >90% of the burst payload
NA	Zero	Zero
CR	An aggregate of 10% of the minimum resources required assuming <10% packet inter-arrival jitter and ≥ 25 pps	An aggregate of 10% of the minimum resources required assuming <10% packet inter-arrival jitter and ≥ 25 pps
CV	Zero	An aggregate of 1% of the minimum resources required
CA	Zero	Zero

Table 5-2. Accepted request overshoot for Real Time traffic under different conditions.

Compliance to the specified request behavior allows the DAMA controller to provide at least 90% utilization of assigned resources by nominal assignment according to any combination of VBDC and RBDC requests. Nominal assignment according to AVBDC requests are of little relevance as a utilization reference as AVBDC requests are substitutive and may occur anytime. Each AVBDC must be seen as a sample of the instantaneous A/VBDC traffic backlog .

[1] It is assumed that there may be no section packing at non-congestion and thus there may be a significant amount of padding.

[2] It is assumed that there at congestion is typically a backlog of traffic that can consume the assigned resources. Thus, section packing will typically occur and there will be close to zero padding.

AVBDC and VBDC may be used in different ways. VBDC may be used without AVBDC, AVBDC may be issued independently of VBDC in parallel, AVBDC may replace some of VBDC and AVBDC may be used without VBDC.

5.1.5 Dispatching of packets

One or multiple RC's CAN be mapped to one VPI/VCI or PID.

If ENHQOS option is supported, RCST SHALL support at least 2 connections (VPI/VCI or PID).
One of these connections SHALL be dedicated to RT traffic only.

For MPEG profile, several RC's CAN be mapped within a pool of several PIDs.

The RCST SHALL dispatch packets into the return link according to the applicable PHB specifications, while observing the priority between PHBs (If ENHQOS option is supported: EF>AF>BE) and accounting for the capacity limit values configured for each RC.
The value of the superframe duration SHALL not prevent the RCST to perform dispatching in compliance with the above requirement.
The RCST SHALL NOT require RC association of the slots in the TBTP.

If the RCST does not implement the CHID_STRICT option or if it does but this option is not enabled:

- The packet dispatching SHALL not be limited by a strict use of the Channel_ID tagging in BTP.
- The RCST MAY give priority for transmission to the traffic of the RC signaled in the Channel_ID field of the BTP, if provided.
- The RCST SHALL operate satisfactorily independent of the Channel_ID association of the slots in the TBTP (see 4.4).

If the RCST implements the CHID_STRICT option and if it is enabled, the packet dispatching SHALL strictly follow the Channel_ID association given in TBTP.

The RCST SHALL be capable of operating with over-booking and congestion for BE, and this MUST be reflected by the performance specification.

The RCST SHALL be capable of operating with over-booking and congestion for CD, and this MUST be reflected by the performance specification.

5.2 RCST performance

Harmonized QoS performance parameters support network operators in the preplanning of network QoS performance. The RCST vendor SHALL provide a specification of the RCST QoS performance. The QoS performance SHALL at least be specified for the standardized PHBs as described in this section. The effect of the DAMA controller MUST as much as possible be eliminated from the performance figures, including any variance in TDMA slot timing and waiting time for TDMA slots. The figures will therefore reflect the RCST specific impact. The proposed measurement methods have this intention.

5.2.1 Overload conditions

Two types of overload conditions are considered. Service Level Agreement (SLA) saturation means demand for more than the SLA maximum bandwidth and getting the SLA maximum (as specified by the Capacity Category parameters configured for the RCST or for each RC). RC congestion means demand for less than the SLA maximum bandwidth but getting even less than the demand.

SLA saturation is at the RCST level, with regard to the SLA maximum; it does not necessarily translate into capacity requests to the DAMA controller (e.g. RBDC requests are limited to *RBDCmax*, even if the demand is higher than *RBDCmax*). By contrast, the RC congestion is at DAMA controller level; it can happen whether the SLA is saturated or not.

5.2.2 Required performance data

The RCST QoS performance specification MUST include a specification of the maximum RCST impact on packet delay and the maximum RCST impact on delay jitter for EF. These figures MAY be specified as a function of the return traffic link rates or MAY be specified as common values for a range of return link traffic rates. The figures must be given for the relevant traffic conditions. The relevant traffic conditions MUST include SLA saturation for the other PHBs, MUST include RC congestion for BE and SHOULD include RC congestion for CD.

The RCST QoS performance specification SHOULD include a specification of the maximum RCST impact on packet delay and MUST include a specification of the maximum burst size for AF3x. These figures MAY be specified as a function of the return link rates or MAY be specified as common values for a range of return link rates. The figures MUST be given for the relevant traffic conditions. The range of relevant traffic conditions MUST include SLA saturation for the other PHBs and MUST include RC congestion for BE.

The RCST QoS performance specification SHOULD include a specification of the maximum RCST impact on packet delay and MUST include a specification of the maximum burst size for BE. These figures MAY be specified as a function of the return link rates or MAY be specified as common values for a range of return link rates. The figures MUST be given for the relevant traffic conditions. The range of relevant traffic conditions MUST include SLA saturation for the other PHBs and SHOULD include RC congestion for CD.

Relevant performance parameters of relevant traffic conditions are shown in Table 5-3. They are Layer 3 parameters (IP level). The measurements shall represent the contribution of the RCST from its LAN interface to its Satellite interface. RFC3393 [12] should be used as guidelines to perform the measurement.

Observed PHB – SLA not saturated and not RC congestion	**RCST Traffic Conditions**					
	Other PHBs less than SLA saturation and not RC congestion	BE load that saturates the SLA and not RC congestion	CD load that saturates the SLA and not RC congestion	RT load that saturates the SLA and not RC congestion	BE load that is RC congested	BE load and CD load, that both are RC congested
EF	*peak delay; peak jitter*	*peak delay; peak jitter*	*peak delay; peak jitter*	*Should state policy*	*peak delay; peak jitter*	*peak delay; peak jitter*
AF3x	*peak delay; max burst*	*peak delay; max burst*	*Should state policy*	*peak delay; max burst*	*peak delay; max burst*	*Should state policy*
BE	*peak delay; max burst*	*Should state policy*	*peak delay; max burst*	*peak delay; max burst*	*Should state policy*	*Should state policy*

Table 5-3 - Relevant RCST QoS Performance parameters for different traffic conditions

5.2.3 How the performance figures can be provided

This section provides guidelines on how the above performance figures can be measured.

5.2.3.1 Measuring the RCST performance for traffic in a single PHB

The impact of the RCST can be measured directly when the observed PHB has the only traffic load of the applicable scenario. Capacity assignment should be consistent with the DAMA controller policy for the corresponding RC. It is assumed that the DAMA controller used for measurements provides BoD (Bandwidth-on-Demand) equal to the demand when the RC is not congested. It is further assumed that in case of RC congestion a fairness algorithm is used by the DAMA controller. The DAMA controller has to be configured to assign a full channel of bandwidth as FCA (contiguous TRF slots). The slot duration should be indicated.

The traffic burst handling capability can be verified by successful transport of each packet in a sufficiently sized burst of packet.

5.2.3.2 Measuring the RCST performance for a PHB with interfering traffic on another PHBs

The impact of the RCST can be measured indirectly when the observed PHB is active simultaneously with another PHB. The peak packet delay and peak delay jitter contribution can be found by measuring the packet delay and delay jitter both without interfering traffic and at application of interfering traffic relevant for the respective traffic condition. The QoS performance is the maximum increase in peak delay and peak delay jitter. It is assumed that the DAMA controller used for the measurement provides BoD equal to the demand when the RCs are neither SLA-saturated nor not network-congested and BE SLA is not saturated. The slot duration should be indicated.

The traffic burst handling capability can be verified by successful transport of each packet in a sufficiently sized burst of packet.

5.2.3.3 Traffic load to be used for measurement of RCST performance

The traffic load for a PHB is either provided as a very regular rate of IP packets of a fixed size or a burst of short duration consisting of IP packets of a fixed size, as applicable for the performance parameter. The relevant IP packet size differs for the PHBs as indicated in Table 5-4.

PHB	Short IP packet (~ 60 bytes)	Long IP packet (~ 1500 bytes)
BE	SHOULD	SHALL
AF3x	SHOULD	SHALL
EF	SHALL	SHOULD

Table 5-4 - Requirement for application of different packet sizes in the performance measurements.

The intention of these rather simple traffic models is as much as possible to eliminate the impact of the dynamic performance of the specific DAMA controller used for the measurement. Also, the regular rate traffic patterns ensure that the interaction between the request system of the RCST and the specific DAMA controller is generalized as much as possible. In fact, the specific DAMA controller may be configured to give precisely the required bandwidth without being sensitive to the capacity requests.

5.3 RCST management

This section defines configuration parameters of RCST. They are incorporated into the HM&C specification [8].

Table 5-5 lists the convention that the RCST supports for the identification of PHBs. The *PHB Identifier* is in the same range as DHCP values [0-63].

PHB	PHB Identifier
BE	0
EF	46
AF31	26
AF32	28
AF33	30
<PHB>	<recommended DSCP value for PHB>

Table 5-5 - Numerical PHB identifiers

Table 5-6 shows the RCST configuration table for mapping from PHB to Request Class. *RC-identifier* is in the same range as *Channel-ID* [0-15]. Additional mappings may be configured by other means.

PHB	RC
EF	<RC-identifier>
AF31	<RC-identifier>
AF32	<RC-identifier>
AF33	<RC-identifier>
BE	<RC-identifier>
<PHB-identifier-n>	<RC-identifier>

Table 5-6 - Mapping of PHB to Request Class

Table 5-7 shows the configuration parameters for the RCST and the RCs regarding Capacity Categories.

	RCST	<RC-identifier-1>	<RC-identifier-2>	<RC-identifier-3>, etc
CRA	n/a	x	x	x
RBDCmax	RCST_PARA	x	x	x
RBDCtimeOut	RCST_PARA	x	x	x
VBDCmax	RCST_PARA	x	x	x
VBDCmaxBacklog	RCST_PARA	x	x	x
VBDCtimeOut	RCST_PARA	x	x	x

Table 5-7 – RCST and RC Capacity Categories parameters configuration

The parameters marked ‘x’ SHALL be supported by the RCST.

The parameters marked ‘RCST_PARA’ MAY be supported (RCST_PARA feature).

n/a means not applicable.

If RBDCmax=0, then RBDC is disabled for the RCST or for the associated RC Class.

If VBDCmax=0, then A/VBDC is disabled for the RCST or for the associated RC Class.

As specified in 5.1.3, the RCST shall use at least one of the Capacity Request Categories authorized by the NCC. Therefore the RCST may not use one of the Capacity Request Categories, even if both are configured for a given RC.

Table 5-8 shows the mapping of RCs into VPI/VCI or PID pool. PID is only relevant if the RCST supports the MPEG profile.

RC identifier	**VCI/VPI**	**PID pool**
<RC-identifier-1>	x	o
<RC-identifier-2>	x	o
<RC-identifier-3>	x	o
<RC-identifier-n>	x	o

Table 5-8 - Mapping of Request Class to VPI/VCI or PIDs

The parameters marked ‘x’ SHALL be supported by the RCST. The parameter “o” refers to the MPEG_TRF option.

6 NCC guidelines

This chapter gathers all the guidelines that are applicable for a NCC derived from the previous chapters of this document.

The NCC WILL configure the mappings between DSCP, PHB, RC, dynamic capacity request types, Channel_ID and VPI/VCI or PID at RCST log-on.

The NCC WOULD use the RC indication given in the Capacity Requests, through the Channel_ID field, in order to apply the capacity assignment policy applicable to this RC.

The NCC WILL NOT overbook CRA capacity for the DAMA operation.

The NCC WILL NOT allocate more CRA capacity to a RCST than the configured sum of CRA for each RC of an RCST.

The NCC CAN overbook RBDC capacity for the DAMA operation.

The NCC WILL apply a fair share algorithm for the RBDC capacity allocation, if RBDC capacity is overbooked.

The NCC WOULD configure the RBDCmax parameters in order that Σ(RBDCmax_*XX*) = RBDCmax_*RCST*.

The NCC WILL replace an existing RBDC request with any new RBDC request received within the *RBDCtimeOut* .

The NCC WILL reset any existing RBDC request at the expiration of the *RBDCtimeOut*.

The NCC WILL NOT allocate more RBDC capacity than that requested or the configured *RBDCmax,* whichever is smaller, to an RCST and to each RC of an RCST.

The NCC WILL consider AVBDC and VBDC as a single Capacity Category and always support both request types when authorised for a given RCST or RC.

The NCC WILL invalidate any pending A/VBDC request issued by a RCST when an AVBDC request is received from this RCST.

The NCC WILL cumulate VBDC requests.

The NCC WILL NOT allocate through A/VBDC more than *VBDCmax* payload units per superframe to an RCST or an RC.

The NCC WILL use *VBDCtimeOut* and *VBDCmaxBacklog* parameters in order to discard pending A/VBDC requests. The NCC WILL reset the time-out to 0 when an A/VBDC request is received. The time-out will expire when the RCST has not sent any A/VBDC request for such a time period.

The NCC WILL reset *VBDCtimeOut* of an RC for each A/VBDC request of this RC received.

The NCC WILL consider that a RCST subtracts CRA from its Capacity Requests.

The NCC WOULD offer sufficient request opportunities in order to cope with the required performance of each RC.

The NCC MAY generate global assignment only (not associate an RC to slots in the TBTP by using the Channel_ID assigned to the RC) or MAY use specific Channel_ID values in the TBTP to indicate the RC intended to utilise each slot.

If the RCST implements the CHID_STRICT option, the NCC CAN force the RCST to use Channel_ID allocations in a strict mode by setting the *ChannelIdStrictDispatching* parameter to “enabled”.

7 Test parameters specifications

This chapter gathers requirements which are applicable to the SatLabs certification tests.

In the SatLabs certification tests:

- If ENHQOS option is supported, *CRA_RT* = CRA parameter for the RCST and *CRA_CD* = *CRA_BE = 0*
- If ENHQOS option is not supported, CRA parameter is set for BE
- *VBDCmaxBacklog* = *VBDCmax* * *VBDCtimeOut*
- *VBDCmaxBacklog_RCST* = *VBDCmax_RCST* * *VBDCtimeOut_RCST*
- Superframe durations of 26.5 ms and 160 ms will be tested