Call for Technologies

Next Generation DVB-RCS

Consisting of

- **DVB-RCS2 – Return Channel Satellite 2nd Generation**
- **DVB-HLS – Higher Layer Satellite**

January 29th, 2008
TM4164

1 Summary

The DVB Project is inviting the submission of candidate technologies that could be considered for all or part of a standard for a future DVB interactive satellite communications system. The IP-based broadcast technology founded communications system, currently with the working name of DVB-RCS NG will consist of

A) A specification for an interaction channel for satellite distribution systems(DVB-RCS 2nd Gen), basically seen as an upgrade to DVB-RCS (1st Gen) physical layer , MAC layer and IP packet encapsulation, and
B) An extended specification beyond the scope of DVB-RCS (1st Gen) for the required support of commonly used IP based protocols and applications (Higher Layer Satellite – HLS), providing interoperability and increasing the performance.

This call for technologies is issued to meet the commercial requirements prepared by the DVB Commercial Module for the Next Generation RCS.

The proponents will be invited to the DVB-RCS meeting scheduled in May 2009 to present their proposal(s).

Key target dates:

A) Indication of interest:	March 2nd , 2009
B) Draft description of the contribution.	March 20th, 2009
C) Final deadline, no extensions:	May 4th, 2009.

Date A) and B) are requested.
Date C) is mandatory and except by invitation no contributions will be accepted after May 4th.

The draft description shall at least include:

- Topic of submission
- Status of technology (current/new)
- Submitting partner(s):
- DVB member status
- A summary description of the technology
- Any other information is appreciated and may be beneficial as it would give the “project” better opportunity to assess the benefits.

Proponents are further encouraged to submit their proposals as soon as possible after this Call for Technology is published.

2 Introduction

The DVB ad-hoc group TM-RCS was formed in 1998 to develop the first generation DVB-RCS system.

The DVB ad-hoc group CM-RCS was formed in April 2008 to evaluate the potential market for a new generation of RCS and to formulate the commercial requirements specification for a new, next generation standard.

Support for the RCS-NG initiative is strong and has so far come from twenty organizations, from all parts of the value chain. The players recognize that RCS is in the risk of loosing some ground to other systems in some growing market sectors and that DVB-RCS NG must be optimized to current and future market needs. It is also clear that it needs to support solutions tailored for the consumer market, while at the same time, probably with different hardware, must protect and advance the current strong capabilities with players that offer variants that are state-of-the-art in the corporate, backhaul, military, mobile and mesh arenas.
It is however expected that the benefits derived from the larger scale of the consumer market along with the features that are required to compete in it will benefit all user segments of the new standard.

While the DVB-RCS NG specification will support two-way DVB based IP layer communications over satellite, DVB-S2 (latest version) shall be mandatory at the PHY/MAC layer in the satellite downlink to terminals. Thus the two specifications that form DVB-RCS NG are as follows:

- DVB-RCS 2nd Gen (interaction return channel) – one way with S2 in the forward link and
- Higher Layer Satellite (HSL) – two ways.

The CM-RCS has identified the following potential markets:

- Consumer and SOHO: fixed and fixed-mesh
- Multi-dwelling: fixed and fixed-mesh
- Corporate: fixed, mobile and fixed-mesh
- Governmental: fixed, transportable, mobile and fixed-mesh
- Backhaul: fixed, transportable, mobile and fixed-mesh
- SCADA (Supervisory Control And Data Acquisition): fixed and fixed-mesh

Two phases of work have been identified for TM-RCS:

- A first phase aimed primarily at fixed star and meshed networks
- A second phase of work on mobile networks

CM-RCS has indeed identified the fixed star specification as the highest priority for market availability but also requested that the work on specifications for mesh can progress as well.

The first goal of this CfT is to address phase 1. However, whilst not directly addressing the mobile case, DVB would nonetheless be interested in responses that indicate how a proposal might be extended to cover the later mobile phase, in a way which maximizes compatibility between both phases. It is anticipated that the mobility extensions essentially will adopt the techniques recently added to the first-generation DVB-RCS standard in version 1.5.1.

In addition to formal proposals targeting a draft specification in response to this CfT, DVB would also be interested in receiving responses that take a form more appropriate for ‘engineering guidelines’. In any case winning proponents must declare willingness also to contribute to guidelines corresponding to the accepted technologies.

The Call is open for responses from all DVB Members, as well as from non-members who would be asked to join as DVB members.

Evaluation of responses will follow immediately after the closing deadline and it is planned that a draft standard for fixed star networks will be available early in 2010. A draft standard supporting mesh should follow soon after, if not completed in parallel.

The objective is further to freeze the main technical specifications for fixed star by the end of 2009.

3 RCS NG – a vertical approach

A recognized limitation when building DVB-RCS systems based on the current DVB-RCS specification is that it covers only the lower OSI layers of the air interface definition without providing essential supplemental mechanisms on network layer and higher layers. This might lead to interoperability issues with overlying networks solution and between RCS solution providers. Therefore there is a clear need to standardize protocols also for these higher layers, associated with the user plane as well as the management and control planes. In this respect, this call for technologies is open to proposals concerning the whole set of OSI layers from the physical layer up to the application layer for data, management and control planes.

For layers above the MAC, it is anticipated that the proposals could include application/adaptation of existing protocols, but dedicated development and new specification may be needed. In this case the work shall be done in close collaboration with other relevant DVB Technical Groups and other standardization fora (e.g. ETSI, IEEE, IETF) with which DVB has a liaison agreement. The higher layers specification shall guarantee a seamless operation with terrestrial infrastructure, application, control and management commercial tools.

4 Areas in which contributions are requested

Responses to this Call for Technologies are requested in the areas identified in this paragraph. However it should be noted that responses need not be limited to the specific techniques identified – indeed DVB invites to receive responses which meet the commercial requirements, but which are outside the initial list of techniques given below.

As well as responses addressing individual technology elements, DVB is also interested in responses that contain whole system or integrated layers proposals. In any case DVB takes the liberty to modify such proposals as appropriate. Respondents therefore can not take it for granted that their proposals will be adopted “as is”.

Respondents should note that, to maintain maximum compatibility within the family of DVB standards, proposals re-using technologies from other DVB standards are highly encouraged.

Technology proposals are requested to be partitioned into two sections. As a general indication, Section A is expected to include proposals addressing physical layer and lower link layer (MAC), while Section B includes proposals addressing satellite higher layer, IP and upper layers and management and control aspects (SHL). Inter-section cross-layer (i.e. cross-section) proposals will be evaluated as special cases. The proponent in this case shall indicate that both sections are applicable and detail the function allocation to the two sections.
Evaluation of proposals will be based mainly on cost of implementation, performance (power and bandwidth efficiency) and user experience impact, while evaluation of Section B proposals will also be based on supported features and tools.

Table 1 below contains a non-exhaustive list of examples of technologies and their mapping to the pertaining sections.

Technology Area	Aspects	Example of Technology Proposals
Section A		
Physical Layer	Coding	Turbo-Phi, 3D Turbo, LDPC
	Modulation	BPSK, QPSK, 8PSK, M-APSK/M-QAM, CPM, ACM, SRRC with low rolloff factor
	Framing	Pilot symbol insertion, Enhanced Framing
	Advanced Techniques	Co-/Adjacent-channel interference cancellation
Lower Link Layer (MAC)	Access Scheme	Enhanced Random Access Channel integrated with DAMA
		Continuous carrier integrated with DAMA
	IP Encapsulation	GS profile with GSE encapsulation
	Transport of Return Link Signalling	Optimized Signalling
Section B		
Upper Link Layer	Virtual Satellite Networks	MPLS, VLAN (IEEE 802.1Q), VPN
	Differentiated QoS & Bandwidth Management	Request classes, QoS mapping
	Support for TRANSEC	Hooks for TRANSEC
IP and Upper Layers	Header Compression	ROHC
	Performance Enhancing Proxy	TCP acceleration, web caching
	IP QoS Differentiation	Diffserv
	Support for COMSEC	COMSEC and PEP integrated solution
Management and Control	FCAPS	Interfaces towards terrestrial broadband networks
		Service management interfaces
		Management protocols
		SW download protocols
		C2P
	Installation Procedures	Plug&Play Tools
		Terminal configuration

Table 1: example of technologies with their allocation to the two technology sections (TRANSEC = Transmission security, DAMA = Demand Assigned Multiple Access)

For what concerns security aspects related to TRANSEC the general guidelines outlined in Annex 4 shall be followed.

5 Assessment of responses

The proponents shall provide an initial assessment of the proposed technologies against the CM requirements. System reference scenarios are provided in Annex 2 as a common reference for the proposal evaluation and to guarantee that the assessment is performed considering realistic commercial assumptions.

The general proposal evaluation shall be based on technical performance and cost of ownership. The performance evaluation shall be based on analytic considerations, computer simulations when needed or existing exhaustive results for technologies already deployed in other systems and directly applicable to RCS NG. No firm decisions have yet been made about the specific criteria that will be used to rank responses - it is not possible to foresee all possible criteria before responses have been received. However, where possible we will try to achieve consensus about the final choice of technologies.
DVB will take decisions largely on technical performance, cost of equipment and complexity and compliance with the requirements. The evaluation will include considering how technology elements from different proposals fit with each other. Other factors will also be taken into considerations, e.g. time to market, coexistence with RCS and migration possibilities from first-generation systems."

Respondents should note that the commercial requirements are prioritized by means of the terms 'shall', 'should' and 'may'. In deciding between technologies, DVB will aim to consider responses which address these requirements in this order of priority – i.e. requirements expressed by 'shall' are considered essential for compliance whereas requirements expressed by 'should' are not perceived as essential for compliance, although compliance with such a requirement is considered beneficiary.

6 Formalities

6.1 General terms and conditions

DVB will not consider submissions that contain detail which is confidential. Those submitting information implicitly acknowledge that any and all information contained in their submission will not be treated as confidential and should not be marked as such. DVB will not distribute contents of submissions to others than DVB members before a possible publication as part of a standard. Access to required software delivered as part of a response to this CfT will be restricted to those actively involved in the RCS NG assessment/ development work.
Where applicable, proponents of technology elements selected for standardization will be requested to make simulation source code available to the public domain.

Receipt of submissions does not imply that the information will be included in any DVB specification.

6.2 Submission Details

The responses to this Call should be submitted by email before the appropriate deadline to the DVB Project Office: *osullivan@dvb.org* with a copy to the chairperson of the ad-hoc group DVB TM-RCSad-hoc group *harald.skinnemoen@ansur.no*.
Zipped documents should be attached in MS-Word and PDF.

Due date and time: May 4th before 12:00 UTC

Please make sure the file sizes are of practical sizes for email, i.e. not more than 5 Mbytes. For larger files, please provide an FTP link for downloads.

6.3 Format of the proposal

In order to speed up the evaluation of the submitted papers, proponents are requested to use the format described below. It should be noted that proposals may be received which do not fully meet this format, or which do not include the full details requested. However priority may be given to those proposals which are more completely described according to this format.
Whilst DVB is keen to receive responses concerning any technology element, it is also keen to receive responses that assemble combinations of elements into a whole system proposal.
As mentioned previously, the first goal of this call mainly relates to the first phase of work: the fixed star and meshed systems. However, it would be beneficial for respondents to show clearly how their proposal could be adapted in the future to cover the areas expected to be addressed by the second phase.

Suggested format

Table of Contents

Contact details
Executive summary
IPR statement
Functional areas addressed
Description of the technology
Simulation model/pseudo code
Backward compatibility with existing DVB-RCS systems
Performance description
etc...

Further details of the required contents of the individual sections are provided in the following.

Contact details for proponent

Individual contact name
Organization
Telephone
Fax
Email
Postal address

Executive summary of the proposal

A brief description of the proposal, preferably in non-technical terms, should be provided. This should be less than 500 words.

Proposed Arrangement for launching RCS NG IPR Pooling

One conclusion from DVB's recent experience with patent issues is that it is desirable to have an early completion of a pooling effort. This provides greater certainty to implementers and can lead to more timely disclosure of essential IPRs. For RCS NG, we would like to attempt to head off the risk of long delays in pool completion. For this reason, contributors to the RCS NG specification will be asked if they are willing to be contacted in respect of a pooling effort. This contact will be initiated soon after the responses to this CfT have been assessed. Therefore, as part of this CfT, respondents are asked to indicate their willingness to participate in the initial steps of a pooling effort if they think that they have IP which is relevant or may become relevant to RCS NG. Respondents are asked to complete Annex 3 as part of their response to this CfT.

Likewise, if a proponent is aware of an IPR held by a third party it is strongly encouraged to mention the owner of the IPR as part of the proposal.

Functional/market areas addressed

The proposals should describe which item(s) of the commercial requirements are addressed, which technology section (A or B) as well as the market profile the proposal is applicable to:

- Consumer and SOHO: fixed and fixed-mesh
- Multi-dwelling: fixed and fixed-mesh
- Corporate: fixed, mobile and fixed-mesh
- Military: fixed, transportable, mobile and fixed-mesh
- Backhaul: fixed, transportable, mobile and fixed-mesh
- SCADA/transaction: fixed and fixed-mesh

Description of the technology of the proposal

The proposals should include a detailed description, including a full sub-system block diagram or other relevant description. If the proposal consists of an entire system proposal, a block diagram of the system should be included. If the proposal consists only of modifications to certain blocks of the current DVB- RCS standard, it should be made clear which sub-system/component of the current terminal and hub architecture would need to be modified.

Simulation results / software model

Before a particular technology can be adopted, it is likely that an independently verifiable software simulation model will need to be developed. Respondents are therefore encouraged to deliver, together with their proposal, as much as possible of the following:

- results of their own simulations demonstrating the benefit of their proposal
- sufficiently detailed description of the proposal to allow a software simulation model to be built

- a software model incorporating their proposal, which would allow independent verification of the proponent simulation results.

The simulation program and its source code should preferably be delivered together with the CfT submission. Proprietary modules not impacting the performance assessment may be omitted from the source code delivery.
The proponents should also provide convincing theoretical explanation of the achievable performance. It should be noted that, before a technology can be included in the final standard, it must be demonstrated that more than one implementation is commercially practicable. It will also help in adopting any technique if sufficient detail is revealed (except the final details of the implementation). Verification of the claimed performance may be requested.

Backward compatibility with existing DVB-RCS systems

It is foreseen that DVB-RCS NG capable terminals and non-capable terminals will be operated in the same network by sharing resources to the extent possible. Sharing of the forward link will be done as it is perceived that most RCS and RCS-NG terminals will utilize compatible types of industry standard forward link DVB-S2 receivers. It must be possible for terminals of all implementation profiles of current and new DVB-RCS/SatCom to co-exist in one system, ideally by freely sharing the return link resources but at least by using partitioned resources.
In this respect the proponent should also assessed if and how the proposed technology allows such co-existence in the network between RCS and RCS NG terminals.

Performance description

The proposals should be backed up with information on how the system performance relative to DVB-RCS is changed by applying the technology. To this end the proponent shall use the reference system scenarios as described in Annex 2. The proponent shall select at least one reference system scenario and clearly demonstrate by means of analysis or computer simulations the benefits in terms of performance of the proposed technology.
Some proposals may not be well described directly as performance figures (particularly the ones addressing Section B). In those cases, other appropriate ways of describing the benefits should be used. Some indications of performance figures for physical layer, MAC layer and system level technologies are given in the following list:

Physical layer performance

For each physical layer mode

FER vs. Eb/No performance in different contexts:
AWGN, user terminal non-linearity, phase noise
Spectral efficiency
Physical frame overhead

MAC layer performance

MAC efficiency and latency statistics: in both congested and non-congested situations, for a variety of traffic profiles matching the target markets
Framing efficiency
Filling efficiency (padding)
Login/Logout performance

System level performance
Achievable number of supported user terminals per MHz, with reference to terminal service assumptions (in terms of supported service data rates and contention ratios)
Achievable overall efficiency (IP bit/s/Hz) defining the possible maximum loading of the system
Achievable link availability, with reference to the assumed fading statistics
Achievable terminal service QoS metrics (in terms of Packet Loss Ratio, delay and delay jitter) as a function of relative system loading, with reference to applicable traffic profiles

Note that the required efficiency gain relative to RCS (1^{st} gen) is to be achieved for the issues defined within the scope of RCS (1^{st} gen), namely:

- Modulation/demodulation
- Burst synchronisation
- FEC
- Link packet integrity

It is encouraged to also propose supplemental methods for increasing the effective gain as experienced by the user.

Complexity/cost, and other commercial requirements

The proposals should have an estimate of the impact of the proposed technology to the complexity and cost (CAPEX, OPEX and NRE) of the terminal and the cost of the service when compared to the present DVB-RCS system. Also the main cost savings and drivers shall be identified.
Specifically the feasibility to implement the proposal in the CR's requested timescales should be addressed.

Other information in support of your proposal

Please use this section to describe any special features of your proposal not covered by the above sections

In particular the following aspects are encouraged to be discussed:
Considerations to applicability to Non-GEO satellites
Use in frequency bands other than Ku/Ka, as requested by CM-RCS requirements.
Security and use for emergency

Annex 1: Commercial Requirements

The following table contains in a synthetic yet comprehensive form the fist of DVB-RCS NG commercial requirements mapped to the different identified market segments.

RCS-NG Specifications		Consumer and SoHo	Multi-Dwelling	Corporate	SCADA/Transaction	Backhaul	Governamental
Must be designed for 30% lower cost with higher provided rate level, lower delay, lower delay jitter and lower loss probability.		√	√	√	√	√	√
Shall support cost effective installation, maintenance and use.		√	√	√	√	√	√
Draft specifications shall be available by mid 2009 for the star transparent configuration with fixed terminal type for the consumer segment, the SOHO segment and the corporate segment. Draft specifications shall be available by mid 2010 for the mesh and mobile configuration. Shall be available for fixed, mobile and mesh systems as per the timescales outlined in section 4.1.		√	√	√	√	√	√
Existing RCS terminals must not be affected by migration of a system from RCS to RCS-NG. The RCS-NGT could e.g. be able to run RCS as a migration solution.		√	√	√	√	√	√
When possible, terminal upgrades from RCS to RCS-NG should be deployable as a remote controlled software/firmware update, with reference to the currently available products in the market in addition to future products. It is suggested current and planned product ranges are evaluated for potential hardware compatibility with proposed features of the new standard.		√	√	√	√	√	√
A forward link should support terminals of all implementation profiles of RCSTs and RCS-NGTs simultaneously, ideally with fully integrated resource sharing but at least by sharing a single carrier.		√	√	√	√	√	√
It must be possible for terminals of all implementation profiles of RCSTs and RCS-NGTs to co-exist in one Satellite Interactive Network (see Section 6), ideally by freely sharing the return link resources but at least by using partitioned resources.		√	√	√	√	√	√
Shall provide commonality and interoperability between implementation profiles. Interoperable implementation profiles shall be provided to satisfy these requirements.		√	√	√	√	√	√
Shall be designed to support IP based application traffic. Common IP based applications used in the various user segments should be supported transparently. The specification will support native transport of IPv4 and IPv6, used separately or in combination.		√	√	√	√	√	√
Should cover functions at different protocol layers as necessary to satisfy performance and efficiency requirements. This includes provisioning of features such as QoS, Performance Enhancement Proxies (to mitigate the impact of the high latency) as well as Management and Control functions (via air interface).		√	√	√	√	√	√
Shall not prevent multiple simultaneous subscriber connections per RCS-NGT towards multiple internet service providers, via multiple feeders and multiple hubs within the same network.		√	√	√	√	√	√
Shall not prevent usage based accounting and billing.		√	√	√	√	√	√
Must be transmission frequency independent.		√	√	√	√	√	√
Shall be designed to operate efficiently in low service cost frequency-reuse multi-spot-beam (forward and return) Ka-band satellite systems as well as conventional Ku-band (or lower) satellite systems and regenerative systems.		√	√	√	√	√	√
Must not prevent hubs from being able to synchronize sessions via IP over terrestrial backhaul in order to manage diversity sites.		√	√	√	√	√	√
Shall allow a RCS-NGT to operate on multiple transponders for transmission as well as reception.		√	√	√	√	√	√
Shall provide robust, scalable and access controlled means for common remote (via air interface) configuration, management and control of the RCST.		√	√	√	√	√	√
Shall provide means for upgrading remotely (via air interface) upgradeable SW/FW image of the user terminal through reliable IP-based downloading mechanisms, including means for efficiently multicasting upgrades to groups of user terminals and means for upgrading of individual user terminals. C.f. other work within DVB.		√	√	√	√	√	√
Essential subsystem interfaces should be recommended so that suppliers of subsystem technologies and test equipment can develop compatible products.		√	√	√	√	√	√
Should support efficient sharing of the full bandwidth of a wideband transponder (currently for example 250MHz bandwidth). Should be designed based on trade-off between cost and gain from increased hopping range compared to RCS in the return channel. These performance/costs points should be evaluated and reported by TM-RCS.		√	√	√	√	√	√
Must allow implementation of multi-feeder and multi-gateway networks. Must allow implementation of a single gateway or single feeder capable of supporting at least 100,000 terminals. The specifications must allow the network and the gateway design to be adapted in scale to the size of the network from thousands to millions of users.		√	√	√	√	√	√
Shall provision for interoperability between equipment from different vendors in order to provide economy-of-scale effects for users, service providers and network operators.		√	√	√	√	√	√
Should apply existing technologies where sufficient and applicable. Where appropriate, existing international standards and relevant aspects of DVB and SatLabs specifications should be adopted in order to preserve investments and achieve interoperability, without compromising the effectiveness of the new standard.		√	√	√	√	√	√

Shall be comparable to alternative access technologies to integrate into and interoperate with current broadband networks considering traffic, control and management (including accounting/billing) planes, as well as user premises and interconnected networks. Should recommend application of network and service interfaces commonly used by the ISPs/Telcos for terrestrial broadband networks.		√	√	√	√	√	√
Must allow COMSEC (e.g. IPsec) support to users and should provide the necessary "hooks" for extending the specifications with TRANSEC functionality.		√	√	√	√	√	√
Must be designed with protection of health and the safety of the user, any other person and inter-system or intra-system interference aspects in mind, in order to support operation of type-approved RCS-NGTs under a common (blanket) licensing regime.		√	√	√	√	√	√
Shall not conflict with directives set forth by recognized regulatory bodies (ITU, CEPT, FCC, etc).		√	√	√	√	√	√
Should provide specifications to systems designed for mesh connectivity. This should be based on current specifications (e.g. complying with C2P, Connection Control Protocol, as specified by ETSI). It should support regenerative satellite mesh systems as well as transparent satellite mesh systems, and for transparent satellite mesh systems that support simultaneous mesh and hub-spoke traffic.		√	√	√	√	√	√
Should include specifications applicable to regenerative systems that most likely allows a terminal designed and manufactured for use in transparent star systems to be switched to regenerative system operation with a minimum of effort, preferably simply by changing to a specific SW image applicable to regenerative operation, or similar.		√	√	√	√	√	√
Target cost of IDU and ODU (Euro - €)		250					
Support of DIY (Do-It-Yourself) installation (including antenna pointing) – allowing standardised alignment and installation tools, for example		√					
No satellite tracking antenna required (unless on a mobile terminal);		√	√	√	√		√
Shall support use of small antennas, comparable in size to competing systems or TVROs in that market.		√					
Size of the IDU should be comparable to ADSL modems		√	√				
Performance Enhancement Proxy (TCP and HTTP) support, compatible with all common applications (e.g. VoIP and video		√	√	√			√
Can operate well at high service contention ratios through graceful degradation at increasing congestion		√	√	√			√
The terminal will operate on forward links supported by COTS receiver chips		√	√		√		
A typical terminal will be capable of operating in a regenerative system if loaded with applicable SW		√	√	***D***			***D***
Shall allow system designs that support different levels of logon load. Shall provide means that facilitates dynamic adjustment of the resources reserved for log on and increase the capacity for simultaneous logon of RCS-NGTs.		√	√				
Shall support IP QoS differentiation of traffic into the following service classes at link level, comparable to those supported by other common IP transport technologies (like the ubiquitous wired access technology Ethernet).		Three home profiles		7 {BK, BE, EE, CL, VI, VO, NC}		4 {BE, EE, VO, NC}	7 {BK, BE, EE, CL, VI, VO, NC}
(See key below)	simple	1 {BE}					
	standard	3 {BE, VO, VI}					
	premium	5 {BK, BE, VO, VI, NC}					
Shall allow implementation of at least the following service availability ratio (where the network is accessible with the specified grade of service).		99.70%		99.90%		99.99%	99.99%
Shall allow any IP based application that can tolerate the satellite propagation delay to be supported.		√		√			
Downlink TCP datarate through the PEP (Mbit/s)		20		256		256	256
Uplink TCP datarate through the PEP (Mbit/s)		2		20		20	20
Shall be useful for a multi-dwelling implementation, where the traffic for one terminal is an aggregate for several subscribers, possibly belonging to different user segments. A subscriber is in this context the legal entity that holds the SLA e.g. a private individual, a company subscriber or an organizational unit of some other type.			√				
The capabilities of a multi-dwelling terminal must at least comply with an implementation profile merged from the specified implementation profiles applicable for the users utilizing the same terminal. The service specification applied for the multi-dwelling terminal is assumed to reflect the individual subscriber service specifications and a relevant multi-dwelling traffic model.			√				
Should recommend an interface for remote configuration, management and control of multi-user access.			√				
Shall facilitate the use of a single terminal for shared access in a domestic environment. They shall also support connection of such a terminal with in-house communication networks.			√				
Should provide means for transport of metadata (e.g. MPLS tags, VLAN tags, user priority) associated to the IP packet, to facilitate the use of RCS-NG for implementing virtual satellite access networks capable of extending multi-network packet switched transport technologies commonly used to transport IP.			√	√		√	√
Proper installation may require a professional installer				√	√		√
Interoperability with wireless terrestrial access (WiFi, WiMax, HSPA)				√		√	
Should support the use of content compression and header compression at appropriate layers of the protocol stack (e.g. VOIP).				√			√
Must allow vendors to guarantee a mean time between equipment failures as high as 10 years (TBC).				√	√	√	√
Must allow operators and vendors to guarantee a maximum time to repair of 1 day (TBC).				√	√	√	√
Shall allow implementations to support automatic hot and cold standby terminal redundancy in critical applications.				√	√	√	√

Shall be a useful specification for extension to simultaneous transparent mesh communication from any given terminal to up to 2000 other mesh terminals			√	√		√	√
Must allow sharing of at least forward link resources between SCADA/transaction terminals and consumer terminals		√			√		
Support transport of X.25 protocol					√		
Support: GSM Backhauling, WiMax backhauling, HSPA backhauling, LTE backhauling						√	
Support all aspects of TRANSEC .							√

Symbols:

✓: Mandatory requirement

D: Desired requirement

Abbreviations used for QoS distinguishing traffic types:

BK – Background
BE – Best Effort
EE – Excellent Effort
CL – Controlled Load
VI – Video
VO – Voice
NC – Network Control

Annex 2: Reference System Scenarios

This annex provides the system scenarios that shall be considered as reference during the DVB-RCS NG standardization for star and meshed networks.

Star networks

The scenarios here proposed represent the main target systems for the new standard. Additionally, these scenarios will be used to derive the key performance and cost parameters that will be taken into account for the evaluation of the CfT proposals.
Two main scenarios have been identified:

- Ku-band satellite with single beam coverage over Europe
- Ka-band satellite with multi-spot coverage over Europe

It is worth noting that, although the proposed scenarios address specific frequency bands, the DVB-RCS NG standard shall be frequency independent. Therefore considerations regarding operations at different frequency bands (in the range from L to V[1]) will be taken into account during the standardization activities, although with lower priority than Ka and Ku bands issues.
During the standardization activities it will be possible to expand the scenario description with additional information if required.

Ku-band Scenario

A single global beam with European coverage is considered.

System Sizing

Applications, services and load conditions

The proponent shall consider the following traffic profiles: e-mail, web browsing, FTP, VoIP, VPN access, interactive gaming, video streaming, file transfer/peer-to-peer, IPTV (possibly with interactivity), as well as IP trunking. Appropriate traffic models shall be combined to reflect a realistic mix of traffic profiles.

If applicable, the proponent shall detail the max number of supported concurrently active user terminals (logged-on) and the max logon rate of user terminals which the proposed system design allows.

Forward-Link Payload Sizing

Transponder bandwidth	36 MHz
G/T	from -4 to 8 dB/K
EIRP per transponder	from 41 to 53 dBW

Return-Link Payload Sizing

[1] W band may also be considered

Transponder bandwidth	36 MHz
G/T	from -4 to 8 dB/K
EIRP per transponder	from 41 to 53 dBW

GW Sizing

Antenna diameter	3.7 m
EIRP per carrier	72.5 dBW
Clear sky G/T	29 dB/K
Tx pointing loss	1.1 dB
Rx pointing loss	0.5 dB
NPR	20 dB
Symbol Rate	30 MSymb/S
Rolloff	25%

UT Sizing

Consumer Terminal Sizing

Antenna diameter	0.96 m
Amplifier power	2 W
Output loss	0.5 dB
OBO (QPSK)	0.5 dB
EIRP	40 dBW
Receiver noise factor	2 dB
Input loss	0.4 dB
Clear sky G/T	19 dB/K
Tx pointing loss	1 dB
Rx pointing loss	0.5 dB

Professional Terminal Sizing

Antenna diameter	1.2 m
Amplifier power	3 W
Output loss	0.5 dB
OBO (QPSK)	0.5 dB
EIRP	43 dBW
Receiver noise factor	2 dB
Input loss	0.4 dB
Clear sky G/T	21 dB/K
Tx pointing loss	1 dB

Carrier and clock instabilities

Max carrier frequency error	4 kHz	On traffic burst after initial synchronization procedure
Max clock frequency error	2 ppm	Assumes NCR lock
Phase noise mask	-16 dBc/Hz @ 10 Hz	As per the DVB-RCS

	-54 dBc/Hz @ 100 Hz -64 dBc/Hz @ 1 kHz -74 dBc/Hz @ 10 kHz -89 dBc/Hz @ 100 kHz -106 dBc/Hz > 1 MHz	guidelines

General Description

A satellite, located at 33°E on the orbital arc, is equipped with a multi-spot Single-Feed-per-Beam (SFB) Tx/Rx antenna and an advanced transparent digital repeater.
Ka band is used on the feeder-link (Tx 27.5-29.5 GHz / Rx 17.7-19.7 GHz) and on the user-link (Tx 29.5-30.0 GHz / Rx 19.7-20.2 GHz). Both orthogonal circular polarizations are utilized.
The user-link coverage, shown in Figure 1, is made of 100 beams with beam width of 0.4°. The frequency plan is based on a 4 colour reuse scheme with 125[2] MHz per spot in both polarizations, in both forward and return link.
The same antenna is used for both the feeder- and user-link. At this regard, up to 28 antenna beams can be activated as gateway beams and used in the feeder link. The on-board transparent digital repeater allows a fully flexible connectivity between gateway beams and user beams.

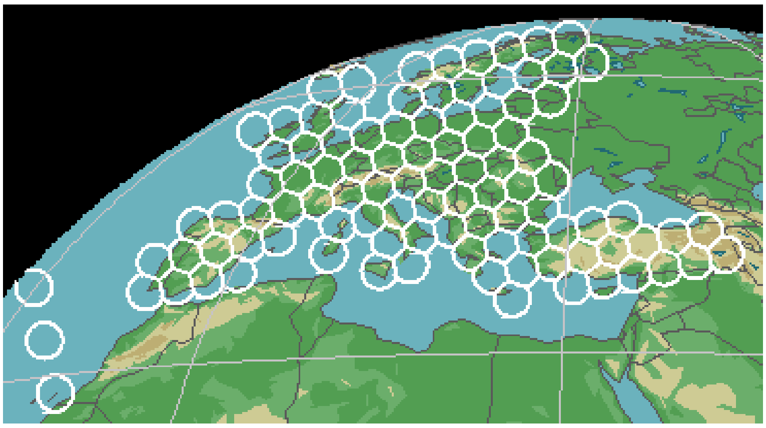

Figure 1 Ka-Band coverage

System Sizing

Applications, services and load conditions

The proponent shall consider the following traffic profiles: e-mail, web browsing, FTP, VoIP, VPN access, interactive gaming, video streaming, file transfer/peer-to-

[2] In the forward link up to 500 MHz transponder bandwidth shall be considered and the system adapted accordingly

peer, IPTV (possibly with interactivity), as well as IP trunking. Appropriate traffic models shall be combined to reflect a realistic mix of traffic profiles.

If applicable, the proponent shall detail the max number of supported concurrently active user terminals (logged-on) and the max logon rate of user terminals which the proposed system design allows.

Forward-Link Payload Sizing

Transponder bandwidth	125-500[1] MHz
Peak G/T	24.2 dB/K
EOC[3] EIRP density	40 dBW/MHz

Return-Link Payload Sizing

Transponder bandwidth	125 MHz
EOC G/T	19.7 dB/K
Peak EIRP density	34.7 dBW/MHz

GW Sizing

Antenna diameter	8.1 m
EIRP per carrier	66.1 dBW
Clear sky G/T	37.9 dB/K
Tx pointing loss	1.1 dB
Rx pointing loss	0.5 dB
NPR	20 dB
Symbol Rate	45 MSymb/S
Rolloff	25%

Consumer Terminal Sizing

Antenna diameter	0.6 m
Amplifier power	2 W
Output loss	0.5 dB
OBO (QPSK)	0.5 dB
EIRP	44.2 dBW
Receiver noise factor	2 dB
Input loss	0.4 dB
Clear sky G/T	15.2 dB/K
Tx pointing loss	1 dB
Rx pointing loss	0.5 dB

[3] EOC gain is 4.5 dB lower than the peak gain

Professional Terminal Sizing

Antenna diameter	1.0 m
Amplifier power	4 W
Output loss	0.5 dB
OBO	0.5 dB
EIRP	52.7 dBW
Receiver noise factor	2 dB
Input loss	0.4 dB
Clear sky G/T	19.7 dB/K
Tx pointing loss	1 dB
Rx pointing loss	0.5 dB

Carrier and clock instabilities

Max carrier frequency error	4 kHz	On traffic burst after initial synchronization procedure
Max clock frequency error	2 ppm	Assumes NCR lock
Phase noise mask	-16 dBc/Hz @ 10 Hz -54 dBc/Hz @ 100 Hz -64 dBc/Hz @ 1 kHz -74 dBc/Hz @ 10 kHz -89 dBc/Hz @ 100 kHz -106 dBc/Hz > 1 MHz	As per the DVB-RCS guidelines

Satellite antenna parameters:

Parameter	**Symbol**	**Value**
Aperture diameter	D	2.64 m
Antenna efficiency	ρ_e	0.63
Roll-off factor	p	1
Edge Taper	ET	10 dB

Annex 5 illustrates an analytical model that can be used to derive the antenna beam pattern

Meshed networks

Ku band

System Sizing

Applications, services and load conditions

The proponent shall consider the following traffic profiles: e-mail, web browsing, FTP, VoIP, VPN access, interactive gaming, video streaming, file transfer/peer-to-peer, IPTV (possibly with interactivity), as well as IP trunking. Appropriate traffic models shall be combined to reflect a realistic mix of traffic profiles.

If applicable, the proponent shall detail the max number of supported concurrently active user terminals (logged-on) and the max logon rate of user terminals which the proposed system design allows.

Forward-Link Payload Sizing (regenerative System)

Transponder bandwidth	36 MHz
G/T	from -4 to 8 dB/K
EIRP per transponder	from 41 to 53 dBW

Return-Link Payload Sizing (regenerative System)

Transponder bandwidth	36 MHz
G/T	from -4 to 8 dB/K
EIRP per transponder	from 41 to 53 dBW

Consumer Terminal Sizing

Antenna diameter	0.75 m
Amplifier power	2 W
Output loss	0.5 dB
OBO (QPSK)	0.5 dB
EIRP	41 dBW
Receiver noise factor	2 dB
Input loss	0.4 dB
Clear sky G/T	17 dB/K
Tx pointing loss	1 dB
Rx pointing loss	0.5 dB

Professional Terminal Sizing

Antenna diameter	1.2 m
Amplifier power	3 W
Output loss	0.5 dB
OBO	0.5 dB
EIRP	46 dBW
Receiver noise factor	2 dB
Input loss	0.4 dB
Clear sky G/T	21 dB/K
Tx pointing loss	1 dB
Rx pointing loss	0.5 dB

Carrier and clock instabilities

Max carrier frequency error	4 kHz	On traffic burst after initial synchronization procedure
Max clock frequency error	2 ppm	Assumes NCR lock
Phase noise mask	-16 dBc/Hz @ 10 Hz -54 dBc/Hz @ 100 Hz -64 dBc/Hz @ 1 kHz -74 dBc/Hz @ 10 kHz -89 dBc/Hz @ 100 kHz -106 dBc/Hz > 1 MHz	As per the DVB-RCS guidelines

Annex 3: IPR

Respondents are requested to provide the following information:

/_/ DVB fosters the formation of voluntary licensing programmes.

DVB intends to begin its fostering process early in the work of the RCS NG specification. It is contemplated that a meeting will be held of lawyers and licensing specialists of contributors on the fringes of a future RCS NG meeting in the course of the project. Please indicate whether you would like to be notified about this meeting by the Legal Director DVB, eltzroth@dvb.org and to receiving further information on the pooling effort.

If so, please indicate the name and email address of your representation to this pooling discussion meeting.

____

(name of IPR specialist)

____

(email address)

Note: the meeting is intended for RCS NG participants that have a well- founded belief that they may hold IPRs essential to the RCS NG specification, including in the form of patents and patent applications.

The Legal Director DVB will call an initial meeting to occur alongside a meeting of RCS NG. The agenda of this first meeting would identify tasks and set a schedule for the work of this Pool Planning Group. The ambition would be to announce a pool shortly after the technical work on RCS NG is completed. The pool would be comprised initially of holders of issued patents and would grow as further patents are granted. It is intended that this initial pool will follow guidelines developed as part of the requirements developed by the Pool Planning Group

Annex 4: Security aspects concerning TRANSEC

The following commercial requirements are related to TRANSEC:

“29 RCS-NG must allow COMSEC (e.g. IPsec) support to users and should provide the necessary "hooks" for extending the specifications with TRANSEC functionality.
74 It shall be possible to support all aspects of TRANSEC .“

For the purposes of DVB-RCS NG, TRANSEC protection has been defined to include (but the proponent may extend this definition):

- Protection of Channel Activity Information – i.e. to disguise User traffic volumes in both forward and reverse channels.
- Protection of Control and Management Information – i.e. to encrypt or otherwise disguise C-Plane and M-Plane signalling and signalling tables in both forward and reverse channels
- NCC and RCST Validation – to ensure that only valid RCST can log-on to a valid NCC and conversely that neither a invalid RCST can not log on to a valid NCC or a valid RCST cannot log-on to a invalid NCC.
- Anti-Jam and Low Probability of Intercept qualities, these are considered to be at a lower priority with respect to the previous points and may be omitted or treated separately

The proponent shall provide an overall description of all the necessary hooks for the extension of DVB-RCS NG with TRANSEC countermeasures, e.g. new signalling, reserved fields in control messages for TRANSEC usage, etc, and shall demonstrate their versatility, i.e. that they can accommodate any TRANSEC functionality.

For that purpose, the proponent shall identify the security requirements of DVB-RCS NG systems, addressing the different scenarios and network topologies targeted by DVB-RCS NG, and shall provide a high-level design of a generic Security Architecture satisfying these requirements.
A high-level overview of each TRANSEC countermeasure shall be provided, i.e. role/function, functionalities allocation and description, major information flow exchanges between entities, as well as the features which should remain open or flexible in its design to satisfy the different scenarios requirements, e.g. cryptographic requirements, evaluation/certification requirements.
Finally, the proponent shall show that the proposed hooks can accommodate each countermeasure and its generic features.

Moreover, the proponent may describe a clear "example" on how hooks can be used with an actual TRANSEC solution.

Annex 5: analytical model of the antenna beam pattern

This annex illustrates an analytical model that can be used for computing the beam pattern of a circular aperture antenna. A more extensive discussion on this subject can by found in "Antennas and radiowave propagation", R.E. Collins, McGraw-Hill 1985.

The beam gain of a generic beam can be represented as:

$$G_j(\vartheta) = G_{MAX,j} \cdot F_j^2(\vartheta)$$

where j is the beam index, $G_{MAX,j}$ is the maximum gain and $F_j(\theta)$ is the antenna radiation pattern.

The maximum beam gain can be computed as

$$G_{MAX,j} = \rho_e \left(\pi \frac{D}{\lambda} \right)^2$$

Where ρ_e is the antenna efficiency, D is the aperture diameter and λ is the wavelength.

Using the parabolic taper on pedestal on a symmetric circular aperture the electric field distribution is given by:

$$E(r) = E_0 \left((1-T) + T \cdot \left(1 - \left(\frac{2r}{D} \right)^2 \right)^p \right)$$

where T is the aperture taper, p is the roll-off factor and r is the distance from the centre of the taper.

Defining

$$\begin{cases} u = \pi \dfrac{D}{\lambda} \sin(\vartheta_x) \\ v = \pi \dfrac{D}{\lambda} \sin(\vartheta_y) \\ \rho = \pi \dfrac{D}{\lambda} \sqrt{u^2 + v^2} \end{cases}$$

the bi-dimensional radiation pattern is:

$$F(u,v) = \frac{(p+1)(1-T)}{(p+1)(1-T)+T} \cdot \left[\frac{J_1(\rho)}{\rho} + 2^{p+1} p! \frac{T}{1-T} \frac{J_{p+1}(\rho)}{\rho^{p+1}} \right]$$

Where $J_p(\rho)$ is the Bessel function of the first kind and order p.

The edge taper in dB is defined as

$$ET = 20\log_{10}(1-T)$$