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Commercial Requirements for DVB-NGH

DVB CM-NGH

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Contents

1. Introduction

1.1. Market need for a second generation DVB standard addressing handheld and mobile devices

Since the introduction of DVB-H significant changes have taken place in the delivery and consumption of multimedia content. Initially, DVB-H was launched to provide linear broadcast services (e.g. TV and Radio) for handheld devices. However, the multimedia content market is going through a profound change from traditional linear content consumption to a range of rich media content consumption. This rich media content includes traditional TV (linear), various video and audio content, images and text messages. The delivery of the content is keeping pace with the user's demand and user's behaviour. Middleware products have also significantly advanced since the launch of DVB-H. The convergence of the fixed and mobile paradigms is another significant recent change. Whether it is service convergence or platform convergence, there is a need to consider the next 10 years requirement in the market place for convergence of devices, delivery mechanisms and platforms.

From a commercial perspective, the experience in establishing the DVB-H services in some parts of Europe shows there is a relationship between DVB-T and DVB-H services. When specified, DVB-T and DVB-H targeted two different usage profiles. Changing media consumption habits and expectations show increasingly that media applications require an ability to view the same content on different devices with varying screen resolutions (e.g. mobile and fixed receivers), or the use of simultaneous distribution of the same content in different formats to suit different devices and users.

With the imminent introduction of DVB-T2, there is a need to look at ways of leveraging the advantages of DVB-T2 in developing NGH in the new paradigm of rich media content delivery in the convergent era.

Radio spectrum is a scarce resource and use of the spectrum by different networks without interfering with each other is essential. Therefore, sharing of spectrum of future broadcasting and cellular networks and effective utilisation of spectrum in delivering services via different networks is essential for next generation systems.

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Considering the above, the scope of this document is to create requirements for the next generation handheld DVB standard as part of the evolution of DVB family of standards, with superior performance, robustness and better indoor coverage than DVB-H.'NGH' is expected to complement Telecom networks such as 3G and LTE. From a commercial perspective, this means an important improvement in robustness and indoor coverage.

2. Core use cases from an end-user perspective

2.1. General trends

Within the last few years substantial change is taking place in digital content distribution and consumption. Naturally it is difficult to define generic trends but there are domains which can already be seen:

Trends:

- Catch-up (non-linear) TV complements linear TV
- Social networking and user-generated content
- Longer viewing times on mobile/portable devices, typically more than the expected 10 minutes
- In-car entertainment becomes more popular
- Watching any time, anywhere, on any terminal is a growing expectation
- Parallel viewing, e.g. zapping on a mobile device in parallel to viewing on a big screen
- Delivery methods for voice, radio and VOD, tend to be more and more IP-based
- Interactivity for seeking/finding content
- Telco operators to offload the burden of unicast media delivery using overlay broadcast networks
- Broadcasters to use unicast technology for enhancement of their broadcast service
- Service continuity across all media delivery networks
- Service providers want to be bearer agnostic

Scenario A:

Even when the TV set is on, viewers want to watch other content in parallel. Small and personal devices, like mobile phones, help to do this parallel viewing. The habit to watch one programme on the big TV set and use the mobile device for zapping is similar to a picture-in-picture mode on some TV sets.

Scenario B:

Mobile TV viewing times lengthen in proportion to screen size. Mobile and portable devices get bigger screens, which make them more suitable for long form watching. Portable devices differ from mobile phones by having larger screens, more efficient batteries, and are typically not connected to a cellular network; they need not have a SIM-card.

Figures from Korea show average viewing time of about 1hour/day. Where mobile TV phone users watch less (1/2 hour/day), but portable TV users watch more (3 hours/day).

Scenario C:

Very often linear TV is complemented by VOD services, pushed by Mobile portals provided by service providers.
Catch-up TV has significant importance. This is a use case where consumers typically want to see a show, a programme which they have missed for whatever reason. Today's programmes are very much scheduled in a periodic manner. And furthermore many episodes are becoming candidates for personal collection.
Typical applications to meet this demand are:

- Podcasts, also full length episodes
- Mediathek applications, embedded streaming clips on a portal

In principle there is a trend that linear TV is complemented by VOD.
Naturally mobile TV usage is very much linked with catch-up TV. Mobile devices and catch-up TV give the freedom to watch TV wherever and whenever the user wants.

Scenario D:

Video services in cars become popular as well. Portable and embedded DVD players brought small screens into the cars. Today navigation systems are used also as mp3-players, picture-viewers and speakerphones. Tomorrow they will be used for watching TV. Rear-seat entertainment systems are an important aftermarket. In-car systems are typically connected with information systems about traffic, navigation, etc.

2.2. Classification of use cases

The commercial requirement from an end user perspective can best be articulated through an exploration of four fundamental factors, each of which shapes the end-user's requirements. These are the user's ***situation***, their ***devices' capabilities***, the ***relevance*** of the experience to them, and the ease by which users can ***access*** services. These factors and their implications in terms of commercial requirements will each be explored in turn.

2.2.1. Situations of use cases

What differentiates a handheld device from traditional TV and radio is the potential for mobility. Mobility means the user experience takes place in situations which varies more widely than with any other. Radio (digital and analogue) has been in use in mobile environment (vehicle and personal mobile/portable) for many years. However, mobile TV poses several additional technical challenges.

2.3. Specific situation based requirements

- Must be sufficiently flexible to deliver content types that match the varying amounts of attention a user might want to devote: e.g. radio, radio with slideshow, high quality (SD) TV.
- Must integrate with 'back channel' technologies to offer a truly immersive, two-way experience (especially in scenario B).
- Must be able to offer extended viewing sessions (scenarios A and B) therefore extended battery life is important.
- Must offer fast access to services (e.g. scenario D, where the user may only have a few minutes to fill) therefore fast start up and channel switching are important.
- Must support alert messaging services, allowing instant message delivery to a large number of users.
- Should be able to act as a 'second screen' by offering content that complements and synchronises with content on DVB-T(2) and other platforms (scenario B).
- Should be possible to offer location specific content.
- On demand downloads/recordings (e.g. for when user is in a situation where there is no broadcast reception).

No	Requirement
1	The system shall be configurable either as a broadcasting system (unidirectional) or as a system incorporating also an interaction channel (bidirectional).
2	The time taken to start to consume NGH services when switching from non-NGH application/service should be faster than DVB-H or other similar systems in the market.
3	The DVB-NGH specification should enable distribution of location based content/services within an SFN with minimum increase to network overhead.

It is likely that in the medium term the terminals will have larger screens: DVB-'NGH' must enable these future service quality improvements (e.g. higher resolution, 2D/3D, Full HD, HD Audio etc.)

2.4. Device capabilities

The array of target device capabilities is greater and more challenging than with, say, traditional TV and radio. Device capabilities may in part be dependent on situation, varying for instance according to the availability of reception or bidirectional connectivity. Service provision may vary between territories and some users may carry one type of NGH device in their pocket but have other NGH devices with very different capabilities on their kitchen worktop or desk at home.

Device variables which are not situation-related will include the amount of local storage memory, battery life, connectivity, processing power, user-interface types, and screen sizes. The requirement from the user perspective is that there is an attractive offering across all device types, that there is a degree of consistency of offer between devices but that the full power of a given device is not unduly compromised. This commercial requirement is detailed in the 'device profiles' section of this document.

It is accepted that the total service interruption perceived by the user is caused by different factors including Radio Broadcast Network, Core Network, and Application. The following targets only concern the Radio Broadcast Network part.

4	The NGH system shall enable significantly shorter service interruption than DVB-H when a user changes from one NGH service to another and in any case be competitive with other state-of the art mobile TV systems.

5	The new specification should enable low power consumption at least comparable to the one of the existing DVB-H receivers.

2.5. Network Accessibility

2.5.1. Specific Accessibility based requirements

- **Wide coverage**—a user access services across an entire territory. The implication is that networks aimed at wide area coverage must be efficient and affordable to build.
- **Indoor coverage –** is an important factor for customer acceptance. Especially in mobile phone domain a good indoor coverage is mandatory. This is because much mobile TV usage is likely to be at home.
- **Robust reception**—must be possible to access services whether indoor or outdoor, stationary, walking or travelling at speed.
- **Consistency—**it should be possible to deliver a highly consistent service across different device profiles; it might even be possible to deliver a service consistent in look, feel and navigation to DVB-T and other services. (Consistency is important in terms of educating users, promotion, enabling ease of navigation as users skip between different devices, and in keeping content provider content creation costs down).
- **Responsive**—quick to start up and to access audio-visual and interactive services, fast channel change times.
- **Distribution neutral**—possible to integrate with other distribution technologies such as 3G, LTE, and Wi-Fi for both one and two-way communications seamlessly.
- **System end to end delay** –important for Live events; e.g. use of the NGH system during sports events. Betting is a lucrative use case when simultaneous watching of the event live and via broadcast mobile TV is used.

6	The DVB-NGH specification should be designed to allow for real time interaction with a DVB-NGH service with a minimum of broadcast downlink latency delay.

3. Transmission and receiving conditions

3.1. Device types to be addressed by DVB-NGH

a) Wearable devices (small enough to be carried in one's jacket or trousers pocket, limited display size, used in all reception environments – indoor and outdoor).

1) NGH earphones (audio only, no display).

2) Mobile phone (perhaps with an LED projector)[1].

3) MP3 and video player with limited display capabilities[1].

4) Mobile terminals suitable for TV reproduction with slightly bigger display than typical mobile phone size[1].

b) Portable devices (small enough to be carried in a briefcase or a daypack (small rucksack), larger display size, used in all reception environments – indoor and outdoor).

1) Laptop, notebook, netbook.

[1] Note that these devices might also be used in cars together with a docking station connecting them to the car's roof aerial and its battery.

2) Portable video player/TV receiver[1].

c) Vehicle mounted receivers, from the simple car radio to advanced infotainment system offering from audio/radio only to TV of higher definition than for 2” displays and navigation devices, for use in all reception environments, primarily outdoors, but also car parks and tunnels and powered by car battery with external antenna.

3.2. Basic TV access categorization definition

Since television might be one of the most relevant applications for NGH, the following table provides an overview of TV applications that shall be addressed by NGH.

Terrestrial broadcast Access categories	**Reception conditions (in the service area)**	**Full service (terminal) Max. Speed**	**Typical Service bit rate**	Receiver Screen dimension	Receiver Antenna/Power source
Portable access	Indoor and Outdoor	0 to 15 km/h	SDTV 4 to 1 Mbps *(HDTV possible)*	Portable set 5 to 19 inch	Wireless, Embedded antenna with external power source with internal backup
Slow mobile access	Indoor and Outdoor	0 to 15 km/h	Mobile TV	Telco Handset 2,5 to 5 inch	Wireless, Embedded antenna with internal power source (Battery)
Mobile vehicular access	In-vehicle	15 to 350 km/h	Mobile TV	Telco Handset 2,5 to 5 inch	Wireless, Embedded antenna with internal power source (Battery)
	Outdoor		Mobile TV	Fixed/Portable 5 to 19 inch	Vehicle mounted antenna with power from vehicle battery

Table 1: NGH TV service definition

It shall be possible to have a specific video encoding resolution for each TV service. Additionally, it shall be possible to have subtitles, which are needed to address some markets.

3.3. Reception environments

DVB-NGH network is expected to operate in the following reception environments:

3.3.1. Mobile vehicular (15 to 350 km/h)

Mobile vehicular reception is considered as speeds from 15 to 350 km/h.

Extremely fast usage scenarios, like reception in fast trains(, aeroplanes etc.) can partly be realized with an externally mounted antenna (car, train) with a reasonable gain, partly with an integrated power amplifier, powered by the vehicle's battery.

Note: Nowadays also wearable and portable devices (see above) are used in cars, on trains and airplanes relying on their integrated or telescopic aerial being part of the device – one of the most challenging receiving conditions.

3.3.2. Portable/slow mobile

Reception is realized with an integrated or telescopic aerial being part of the device. Mobility is limited to pedestrian/slow mobile speed ($\leq$15 km/h) and terminals are used in- and outdoor. The pedestrian channel profiles are based on this assumption.

Note: Wearable and portable devices are used outdoor (rural and urban) and indoor, reception is realized with a hand-held or portable device (typically in hand or pocket), the viewer is walking (indoors or outdoors).

7	The DVB-NGH specification shall be optimized for outdoor and deep indoor portable and slow mobile reception (pedestrian $\leq$15 km/h).
8	The DVB-NGH specification shall also be optimized for in-vehicle and outdoor mobile vehicular reception (15 to 350 km/h).

3.3.3. Co-existence with other wireless communication systems

As the Multimedia services develop further, more and more of the services consumed would be interactive. It is anticipated that a significant amount of terminals will consist of a broadcast receiving component combined with other wireless communication components. Examples of the wireless communication components are e.g. Bluetooth, wireless LAN and 3G.

3.3.3.1 Coexistence with telco networks, e.g. LTE

Optimizing service convergence for end-users' benefit in order to offer – seamlessly - the best last-mile bearer, at a given location (or moment of the day) for a given service (or set of services). DVB-NGH needs to embrace the opportunity of becoming an integral part of the wireless Internet in order to use in the best way its existing assets. On one hand, it will be a real advantage for "NGH services" to be broadcast by LTE means in areas without NGH coverage (low customer density), on the other hand the high performance DVB-NGH network in highly populated areas will enable the delivery of push "LTE services", such as mobile TV/radio.

DVB-NGH is not a competitor of LTE, but a complementary overlay network, particularly in areas and at times where the broadcast capabilities of LTE will have limited capacity as network resources are allocated for point-to-point active Telco users.

9	The DVB-NGH specification should be designed for co-existence with other broadcasting and wireless/mobile telecommunication systems on the transmitter/base station side.
10	The DVB-NGH specification shall be designed for allowing co-existence with other broadcasting and wireless/mobile telecommunication systems on the receiver/mobile station side.

4. Characteristics of the DVB-NGH specification

4.1 Frequency bands, channel bandwidths

In radio systems, one of the key and scarce resources is spectrum. Currently, there are no harmonised spectrum allocations for mobile TV in all 3 regions of the world. However, the digital switch over and freeing up of other bands may result in spectrum becoming available for mobile TV and related applications. To accommodate this situation and considering a wide variety of usage of NGH, the NGH specification should be versatile to be able to provide reasonable QoS in a range of frequency bands.

11	The DVB-NGH specification shall be designed to operate at least in the frequency bands III, IV and V, L-band and S-band.
12	DVB-NGH shall be designed to operate in RF channel bandwidths of 1.7, 5, 6, 7, 8, 10, 15 and 20 MHz.
13	DVB-NGH shall meet interference levels and spectrum mask requirements as defined by GE06 (and hence not cause more interference than DVB-T or T-DAB would do). It would be highly desirable if DVB-NGH could cause less interference than other broadcast systems for mobile TV.

Note: The applicability, for broadcasting purposes, of the three widest bandwidths (10, 15 and 20 MHz) in requirement 12, depends on the corresponding spectrum regulation and assignment.

4.2 System characteristics

System characteristics have been split into two sections. First the upper layer protocols, i.e. the protocol layers that of IP or TS and above are discussed within section 4.2.2. Next, the multiplexing and physical layer characteristics are provided within section 4.2.3.

Two main applications areas (but not necessarily separate) are to be considered:

1. DVB-NGH in combination with mobile networks like LTE where the deployment of a fully end-to-end IP based systems will be required, including the full support of an IP transport layer within NGH enabling to deploy hybrid network topology to deliver the same audio/visual content over the two networks, in a bearer agnostic way.

2. DVB-NGH in situation when bandwidth efficient transport protocol ,and/or infrastructure reuse with other DVB broadcast systems is required, allowing use of the same transport protocol as other broadcast bearer like TS (e.g. DVB-T2, S2).

4.2.1 Upper layer

DVB-NGH shall enable broadcast and interactive types of service delivery as described in section 2.0 including hybrid delivery methods for media content.

It should however be clear that there shall be support for the delivery of “broadcast” type of services across different networks and supporting continuity of service.

These requirements are not necessarily addressed in NGH but in the upper layer solution.

NGH technology should be open for any future business models as well as being compatible with existing business. Therefore, the upper layer solution should not be mandated, nor restricted. DVB should encourage competition by leaving up to the market the opportunity to innovate and choose the best and most efficient solution to be used on top of NGH regardless of the application area.

On the other hand, at the time of writing (June 2009) for some major Telecom operators, OMA BCAST is preferred as the upper layer solution. Also, some DVB members, including operators, vendors and manufacturers, have expressed the view that for NGH to be commercially viable, market fragmentation in terminals, service platforms, hardware and software, should be avoided.

4.2.1.1. Upper layer definition

Specification	Enabled use cases
Service Guide	Entry point to discover, purchase and consume: ▪ TV and radio services (broadcast but also unicast) ▪ File downloading services (e.g. news)
Service and Content Protection	▪ Defines the encryption and key management schemes (key topic for telcos to use the SmartCard for keys/rights storage and authentication while subscribing). ▪ Allows different offers models: subscription/pay as you go, live/playback etc. ▪ Enables parental control
Services	Enables specific services: ▪ Service provisioning/purchase, ▪ Terminal provisioning (ex. firmware updates) ▪ Interactivity associated to main services (e.g. SMS voting, web links)
Distribution	Defines protocols for file and stream delivery

Table 2: Upper layer definition

14	The NGH system shall support both IP-based and TS-based upper layer solutions, taking into consideration the two application areas as in chapter 4.2.

4.2.2. Multiplexing and physical layer

Simplicity of the protocol stack is important from the network implementation and from the receiver implementation perspectives. When optimized use of network, or more preferably, a combination of two related broadcasting systems (e.g. DVB-T2 and NGH) is used, both systems should share multiplexing protocols to avoid simulcasting etc. From the receiver perspective it is even more important to avoid unnecessary implementation of several different possibilities for demultiplexing schemes. Hence dual stack solutions (e.g. PES over TS and IP over GSE in parallel) should be avoided and a single stack solution preferred.

15	The system shall be designed for terrestrial use and it may also contain a satellite component.
16	In ideal channel conditions the DVB-NGH specification shall enable a Quasi-Error Free (QEF) quality of service, i.e. less than one uncorrected error event per hour. For all channel models identified as relevant for portable and mobile reception the DVB-NGH specification shall enable a quality of service equivalent to no more than one corrupted second to any audio or video component per minute.
17	The system shall support in-band configuration of remote sites.
18	The system should support for the transport of the whole stream to transmitters over non synchronous networks such as IP.
19	Individual quality for service components should be possible.
20	The NGH standard should offer graceful degradation mechanism in fringe areas of the network.
21	The system shall allow flexible network design – SFN and MFN. For MFN, it should accommodate multiple configurations (robust or high Doppler) within an MFN.
22	The NGH standard should allow for a NGH service to be offered in different qualities. The lower quality being more robust, e.g. based on the use of scalable video coding.
23	The system shall enable use of shared service components for different services, e.g. Teletext, alert messaging.
24	The video, audio or data net throughput shall be maximized for a given reception condition (e.g. C/N), i.e. overheads such as packet headers and metadata should be minimized, without losing functionality.
25	Dynamic multiplex reconfigurations should be enabled and should be followed seamlessly by the terminals.
26	Automatic service following - as seamless as possible - should be enabled from cell to cell and also to other bearer systems including DVB-H.

Comments: DVB-H is commercially deployed in several European countries and should be accessible from DVB-NGH systems.

4.3 Interface between physical and upper layers

NGH will be used to deliver a wide range of multimedia services including Linear TV and interactive services. A variety of middleware and application layer systems will be deployed to

deliver these end user services and applications. The existing deployed network/system should be able to deliver the existing services/ applications using NGH without significant changes or investment.

27	The DVB-NGH specification (physical layer specification) shall be designed to be transparent to higher layers. While this is the case it is still highly desirable that the total DVB-NGH system allows for cross-layer optimization.

5. Implementation, backwards-compatibility, phases towards market introduction

5.1. Implementation

The DVB-NGH system should be more efficient than the expected UMTS-LTE broadcast mode and enable a network coverage equivalent to UMTS-LTE network at a lower cost (considering e.g. 10% of the population of a geographical entity such as a whole town and the same services).

Besides the requirement on performance increase of DVB-NGH compared to DVB-H, DVB-NGH should also perform significantly better than other existing DVB standards, including DVB-SH.

28	The preference, in terms of performance improvement, is on robustness and indoor coverage. Recognizing that capacity can be traded for robustness, the overall capacity improvement, for a given robustness, shall be at least **50%** compared to DVB-H.

Remark: DVB-NGH should also target reducing the required transmit power, considering that transmit power limitation regulations may become more stringent across Europe in the future.

5.2. Backwards-compatibility

On the receiving end new terminals will be required for NGH. As far as the provider side is concerned, existing equipment and facilities should be re-usable as far as possible, i.e. investments made in existing DVB-H infrastructure shall be protected. It is essential that spectrum used by existing DVB systems should efficiently utilised either reusing or sharing of the spectrum used for existing DVB systems as far as possible.

It may be desirable to re-use or share existing or future network infrastructure and spectrum. The underlying aim is to reduce costs in order to ensure implementations are commercially viable. A second underlying aim is to ensure that investments made are not undermined.

An associated technical challenge is how to efficiently configure a multiplex such that it can deliver maximum throughput (for example for HD services) to fixed rooftop antennas and, simultaneously, deliver comparably robust indoor/mobile reception to handheld devices.
Consideration should also be paid as to how each service type might complement the other: for example, in areas of poor fixed HD reception might an SD ‘mobile’ service be provided as a fall back or a ‘fast tune’ service to a fixed antenna; conversely, might a ‘handheld’ device also be able to decode some or all of an HD or SD?

Significant amount of advancement is achieved in T2 compared to T. As DVB-H took advantage of T experience and technology, NGH should leverage the T2 development to the maximum to enable a common platform for DVB, along with other DVB second generation technologies.

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29	The DVB-NGH specification should allow for the re-use of DVB-H RF network structures mixing several sites profiles (e.g. from high power/high broadcast towers to low power/low sites similar to 3G sites) and distribution networks as far as possible.

Comments: given the high cost of a mobile network for indoor coverage, it is highly desirable to reuse existing structures to the maximum, and enable a progressive roll-out by using e.g. higher power sites to initiate coverage at a competitive cost.

30	It shall be possible to combine DVB-NGH and DVB-T2 signals in one RF channel

5.3. Phases towards market introduction

Assuming that the standardization process can begin by the end of the third quarter of 2009 and that this process will last – in the light of significant technical challenges to be met - for two to two and a half years, the publication of the related ETSI standard(s) is expected for 2011. Devices might then become available in 2013.

It is expected that by 2015 timeframe, the Rich Media content consumption will increase several fold and the content will be consumed using a variety of devices. To facilitate this Rich media content consumption, an efficient, flexible and robust NGH system is needed. With the digital switch over and convergence of fixed and mobile services along with telecommunication services, the NGH system is required in a 2013 time frame to be successful in the market place.

No	Requirement
31	The DVB Technical Module is requested to complete the DVB-NGH technical specification(s) by the end of 2011.