Digital Video Broadcast Europe

欧州のデジタルビデオ放送

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Abstract

In Europe there are many initiatives to replace the costly and high power analogue transmitters by DVB-T. Various countries and regions have started such services.

Portable indoor reception will trigger mass markets and a new specification: DVB-H (Handheld), based on DVB-T standard (EN 300 744) is being developed.

There are ideas from ETSI and CENELEC for defining/creating standardized work programs for hardware and software mandated/supported by the EC (European Commission). EICTA (European Association of ICT Manufacturers) is working on a E-Book C (Cable), however ECCA (Cable Association) is not co operative with EICTA's open specifications.

This paper explains the ongoing standardization work on DVB-H, DVB-C, Services, APIs (Application Program Interfaces) and receiver introduction.

欧州では高価で消費電力の高いアナログ放送用送信機を地上デジタル放送（DVB-T）用機器によって置き換えていこうという機運が高まっており，様々な国と地域で既にサービスが開始されている。また，巨大な市場を形成すると期待される携帯機器を用いた屋内での視聴に対応するために，DVB-T（EN 300 744）をベースにした新しい規格DVB-H（Handheld）の検討も開始された。

ETSI（欧州電気通信標準化機構）とCENEREC（欧州標準化委員会）からはハードウエア及びソフトウエアに対する標準化プログラムをEC指令として規定していこうという意見も出されている。EICTA（欧州情報通信技術製造者協会）ではE-Book C（Cable）を検討しているが，ECCA（欧州ケーブル通信協会）はEICTAのオープンな仕様に協調した動きを取っていない。

本稿では，DVB-H，DVB-C，サービスにおける標準化動向，及びAPI（アプリケーションプログラムインタフェース）と受信機の導入状況について解説する。

Introduction

The European DVB (Digital Video Broadcast) Consortium with 250 members has developed Standards for DVB-T, C, S; based on those, almost all countries have plans for Service introduction in the year 2004.

UK has written a successful Freeview story on DVB-T and Germany is ready to follow based on a "Island approach".

So far DVB-C (Cable) business isn't successful, because of the pay TV services and protectionism. There are quit a few people demanding that ECCA (European Cable Association) should adopt an open market strategy.

EICTA is in the process to define E-Book C specification for RF Broadcast Interface Module (BIM) and the return channel (OOM).

ETSI (European Standard Institute) and CENELEC (European Norms) had a start up meeting in Brussels to trigger a "Standardization Work Program for iTV (interactive TV).

This paper summarizes the ongoing topics:
DVB-Broadcast-Service Implementation

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Important Standardization - DVB-H (Handheld)

Implementation of APIs: MHP and MHEG 5

ETSI + CENELEC standardized program on iTV

1.   DVB-Broadcast -Service Implementation

1•1   DVB-T (Terrestrial):

In Europe there are three countries- UK, Germany, Finland, which provide regular services. Many more countries have started tests and have detailed plans for service introduction.

United Kingdom (UK)

The UK was the very first country in the World to introduce DVB-T three years ago. This pioneering task was very successful with regard to functionality of the system; unfortunately, it started with Pay TV services and the receivers were 100% subsidized.

The Operator ITVDigital became insolvent and BBC and Crown Castle took over after 6 month of intensive testing to optimize the transmission parameters. "Freeview" services started on 30 October 2002 but with parameter change from 64 QAM to 16 QAM, transmitter power increase by 3db for enlarged area coverage.

UK operates 6 Multiplexes (Mux)- BBC 4Mux, D3+4, SDN 2 Mux but still in 64QAM. To date there are some 2.3 million households connected.

Digital Switch-over:

The UK Government has given an indicative timetable (2006...2010) for the start of the switchover process. Three criteria must be met before the process can start:

-Affordability of cheap receivers

-coverage- at least 90%

-penetration- >90%

Specification:

The UK DTG (Digital Terrestrial Group) has published updated functional specification for receivers.

The document TDN-DTG Joint Receiver Specs will form the basis of a revised section of the UK D-Book.The new section: "Receiver Requirements" will replace the existing functional specs.

Germany

Services provided will cover the big City areas with 3 to 4 Mux. **Fig.1** provides details of the German Island approach. The frequencies being used will be mainly above 470 Mhz. Later the transmissions will be extended to the whole country step by step. Within the transition period of three to four years, there will be Simulcast- analogue and digital Services. After this transition phase all analogue

Fig. 1   German DVB-T Island approach.

transmissions will stop in those areas.

The first City to start DVB-T was Berlin area (28 Feb. 2003) with a population of some 4.3 million people, 25 programs are available with around 200.000 Viewers by end 2003.

Berlin Broadcast is tailored for portable-indoor reception. Since August 2003 at the start of the IFA Electronics Exhibition all terrestrial analogue services were switched off and 7 Mux are in operation using ch 7, 25, 27, 33, 44, 56, all using SFN (Single Frequency Networks) with 2 to 3 transmitters.

In spring 2004 Cologne, Duesseldorf will start as well with 5-6 Mux in a SFN. These services will come 50/50 % from public- and private- Broadcasters.

Specifications:

There is a group called German Action Group -AG DVB-T that has worked out min. receiver requirements for Hardware and Software Download thru the air. The requirements are naturally based on the EICTA (European Electronics Manufacturers Association) E-Book T (terrestrial) specifications.

Finland

The Ministry of Communications granted the licenses for 3 Mux 9 June 1999). The licenses were given for 10 years and it was decided at the same time that all analogue TV Services would be void by July 2007.

The DVB-T transmission started on 1 Sept. 2000 in 8k OFDM, 64 QAM, code rate 2/3 and a guard interval 1/8. First commercial MHP (Multimedia Home Platform) receivers were introduced to the market by end 2002. During the first few months following, the introduction the number of set top boxes (STB) sold was high demonstrating clearly, that there was a demand for services

like Enhanced EPG (Electronic Program Guide), Super Teletext, Home Banking, Lottery etc currently available with MHP.

Specifications:

The reference specification is based on the Nordig II document, valid for Scandinavian countries and Finland.

Other European countries such as Austria, Italy, Spain, Russia and the Czech Republic have clear DVB-T introduction scenarios for year 2004/05.

1•2　DVB-C (Cable)

Countries with already a relatively high percentage of digital Cable connections are UK with 8%, Germany 5%, Sweden 4% and some other countries have also started services such as Ireland, Spain, France, Belgium, Denmark and Netherlands.

So far the Cable market is predominantly Pay TV with a variety of "protected receiver concepts". The body of the Cable Operators called ECCA (European Cable Communication Association) has unfortunately not created an open Cable platform, preventing the participation of all manufacturers in a "horizontal market".

Germany

Various operators try lure potential subscribers with attractive Pay TV services and low cost phone calls. Germany is an example for that; after German Telecom has sold most of their Networks to private companies such as UPC, ISH IESY.. the battle for subscribers started. ISH has started services in Dec 2003 providing some 50 channels to 1.4 million of its 4 million customers in the Duesseldorf, Cologne, Dortmund area with free and pay channels.

United Kingdom

The UK Cable industry, long dominated by the overwhelming structural problems, seems to see brighter skies in year 2004.

As far as digital Cable TV is concerned, NTL has 1.4 million and Telewest 1 million customers.

The UK Cable business seems to have the problems as in other countries and it is believed that this is because no "horizontal market".

Specifications:

The EICTA (European Electronics Manufacturers Association) has started an initiative to create "Open Cable Specifications" hopefully supported by the ECCA.

The work on the E-Book C (Cable) will be finished by summer 2004.

It seems to be essential for ECCA to change their "closed-protected- garden approach" and to open up for the horizontal markets.

This means that the E-Book C should become the ideal (only) platform to bring Cable-service providers, Network operators and receiver manufacturers together for the creation of a successful Cable business.

1•3　DVB-S (Satellite)

Satellite service distribution is predominantly Free-view Broadcast and some Pay TV, whose main player is BskyB/UK, Canal+/France/Spain, Premiere World/Germany.

Free - view services with some 200 channels are available all over Europe because also high power Satellites- Astra 1D are in operation.

It is estimated that by end 2004 some 15 million DVB-S receivers are in operation.

BskyB, the biggest operator has some 7 million subscribers (subs), but experts believe that the "saturation level" will be reached at 7.5 million subs.

1•4　High Definition TV (HDTV)

All of a sudden, HDTV has become an important topic not only around the globe but also in Europe. In the UK the

Table 1　Roadmap of iTV receivers.

	Available/Initiatives Specifications		Standardization Work Programme
	Initiatives	Standards	
Terrestrial	EICTA E-BOOK-T Based on: Digitag, Nordig, UK d-Book, Aniel	IEC 62216	Complete Terrestrial specifications for people with disabilities
	UK d-Book		
	Unified NORDIG 4 Profiles		
Cable	ECCA Commercial Requirements		Develop Cable specifications in cooperation EICTA, ECCA, Nodig Cable
	EICTA Cable E-Book-C		Consider requirements for people with disabilities
	NORDIG Cable Finnish		
Satellite	Vertical Platforms Specifications		Complete DVB-Interfaces to cover iDTV relevant scenarios. Consider requirements for people with disabilities
	Generic Physical Layers and Connections Specifications	DVB Interfaces IRDs	Develop satellite receiver specification for Free-To-Air Reception
Assistive Services Require-ments		ETS 300 743 v1.2.1 DVB Subtitling	Consider methods for delivery of Digital Signing (low bit rate channels avatars, etc)

interest is high and through DTG (Digital TV Group) Widescreen Forum a number of activities are underway. It can be expected that frequency allocation will be defined in the "Analogue post switch over world.

Germany is very eager to work on HDTV and consequently the German TV platform has crated the HDTV action group, which had its first meeting in January 2004.

The EBU (European Broadcasting Union) in Geneva representing all European public Broadcasters is becoming now involved into HDTV and plans to trigger a program in 2004.

2. Important Standardization- DVB-H (Handheld)

2•1 Why DVB-H Standardization?

In year 2003 the Technology body of DVB consortium, called DVB-TM (Technical Module) created the DVB-H group.

The motivation for the work was to address the important Handheld terminals - PDAs, Mobil phones etc. but without changing the DVB-T transmission Standard. In essence the task for DVB-H is to amend DVB-T standard EN 300 722 for the special needs of Mobil reception, mainly IP (Internet Protocol) content.

Solutions have to be found to drastically reduce the power consumption of terminals and increasing the error protection by using additional MPE-FEC correction.

Again it should be underlined that the DVB-T physical layer shall not be modified and that the amended standard will affect the Modulator.

2•2 Where will DVB-H play its role?

Basic facts of Mobil reception:
- Doppler tolerance in 8k OFDM mode is worse than in 2k and it is thought that 4k is a good compromise.
- DVB-T interleavers are not very long, as thy are optimized for fixed reception- DVB-H requires more interleaving.
- Lower constellations (QPSK, 16 QAM) tolerate a fair amount of Doppler and require less C/N
- DVB-H content will deliver in the same Mux as DVB-T Broadcast services.
- The receiver Front End power consumption has to be much less and the target is less that 25% of present tuners. The average consumption is 450 mW and max 80 mW shall be achieved.
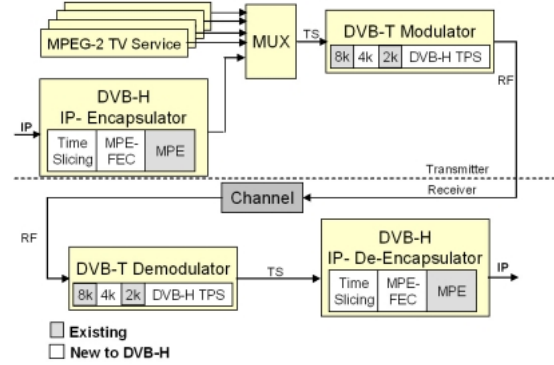

Fig. 2   DVB-H functional blocks.

- DVB-H will implement inner/outer interleaver and inner/outer FEC (Forward Error Correction).

Assuming that 25% of the DVB-T Mux will be assigned to DVB-H (in Germany 3.7 Mbit/s) and   additional error protection- MPE-FEC (Multi protocol encapsulation), then 6 DVB-H Video streams could be packed into a 8 Mhz channel.

In **Fig. 2** the DVB-H functional blocks are being outlined. On the transmitter side there is in addition to DVB-T MPEG2 TV services the DVB-H encapsulator with important blocks MPE-FEC, Time slicing and in the modulator 4k OFDM and the TPS-signalling bits of DVB-H. On the receiver side there is the DVB-T demodulator and the DVB-H IP de encapsulator.

System concept elements:
- Time slicing for power saving
- MPE-FEC for performance enhancements- by re using the memory of time slicing there is the effect of a virtual time interleaver
- 4K mod for mobility specially in medium/large SFNs
- Extended TPS bits serve as efficient signalling

2•3 Performance results for MPE-FEC

The Swedish DVB-T Network provider Teracom studied the performance of MPE Multiprotocol Encapsulation Error correction in detail. Especially system tolerances against Impulse Noise were studied.

The existing simulations of different DVB-T modes on typical Urban, Rural area and hilly terrain were applied to estimate the required C/N for error free IP datagrams.

Main results for mobile channel
- The required C/N with MPE-FEC is very stable and little dependent on Doppler frequency and channel profile.
- Gain in dB with MPE-FEC for the same IP throughput is often large (5-6 dB).

• Reception of 4k OFDM,16 QAM, CR 2/3,GI= ? and a transport stream (TS) of 15 Mbit/s is possible at a C/N =23 dB at 80 Hz Doppler frequency.

2•4 DVB-H time plan for specification and receivers

Final discussions for the DVB-H specs will be made in spring 2004 by DVB-TM (Technical Module); it must be said that the concept elements as outlined before will become the backbone of the specification. The DVB-H meets on a monthly basis to refine and verify the concept.

In December 2003 test transmissions started in Helsinki/Finland on 522Mhz with one 100 Watt and four 20 Watt transmitters. Test receivers were provided by Nokia.

All tests conducted so far meet or exceed the predictions of the DVB-H experts group. The standardization process **Fig. 3** provides the links to other related standards.

Broadcasters and Telecoms service providers are very eager to implement services. The fact that the DVB-T Mux will also be used for DVB-H could provide additional income for all in the value chain.

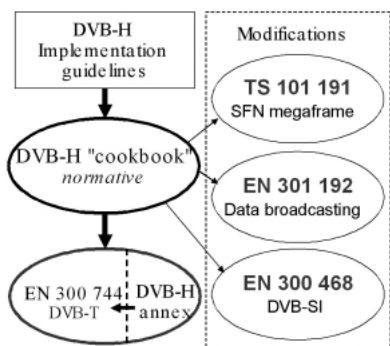Some companies have already announced to have receivers and a network by summer 2005, **Fig. 4**
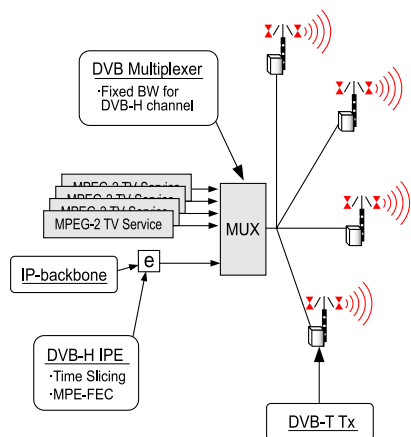

Fig. 3　DVB-H standardization.

Fig. 4　DVB-T and DVB-H sharing Mux.

3.　Implementation of APIs: MHP and MHEG5

APIs (Application Program Interface) become steadily a reality in the market. These are presentation engines and create real added value of digital TV experience for the viewers.

In Europe there are two open APIs, MHP (Multimedia Home Platform) developed by the DVB consortium and MHEG 5 for the UK market, which was primarily tailored for the dig. Terrestrial market with bit rate limitations.

3•1　MHP standards

MHP is an evolution of existing APIs and tailored for Satellite, Cable and Terrestrial. There are three layers
• Enhanced Broadcast (Standard MHP 1.0)
• Interactive Broadcast (Standard MHP 1.1)
• Internet Broadcast basically HTML

3•2　MHP introduction in Europe

It is important to note that the use of "Open APIs" will become mandatory in the new European Telecommunication law.

Finland:

Launch of services started in Aug 2001 on terrestrial and cable networks.

NORDIG countries (Scandinavia)

Migration to MHP will take place until 2005. Broadcasters and network operators have signed an MoU stipulating the migration path.

Spain:

MoU signed in 2002 by broadcasters, network operators and the industry. Start of services is planned in 2004.

Belgium, Switzerland:

Trials and regular services will start in 2004.

Germany:

There are already a few MHP applications provided by public broadcasters ARD, ZDF and RTL (private) The IRT (Institute of Radio and TV Research) in Munich has strong influence to push MHP. They arrange regular MHP-interoperability workshops for receiver manufacturers and have plans for establishing an Application Test Center.

T-Commerce applications based on MHP are already reality in big retail chains and Home shopping (e.g. Karstadt-Quelle, Otto Versand).

Unfortunately there are bit rate limitations on terrestrial and the future will show if MHP could be applied.

3•3   Lean API

In the past there were many discussions to create a separate lean API as a low cost standard in addition to the MHP. The German public broadcasters are strictly opposing this as they invested much into the MHP.

Broadcasters demand that manufacturers provide MHP-receivers not only for Satellite, Cable but also for Terrestrial!

Based on the comments form broadcasters and the fact that MHP implementation cost - hardware and software-become rapidly lower lean APIs seem to have no chance in Europe.

3•4   MHG 5 API for the UK

Since the start of Free view services two years ago applications were offered, however they will not reach the level of MHP 1.0, 1.1.

By early 2004 the updated version MHEG 5 profile v. 1.06is being delivered to the receivers via software download (SWD) function. Because of the number of different receivers involved, especially idTV a large-scale operation is underway.

The UK engineering channel delivering SWD has a capacity of 50 kbits in Mux 1. There is hope to get 100kbits in the future.

4.   ETSI + CENELEC standardized program on iTV (Interactive TV)

4•1   Market development aspects on iTV [4]

It is undisputed that iTV growth will be supported by the portability of services across markets, no matter whether they are organized in a vertical or a horizontal way.

The standards for iTV -Service Information (SI) and Multimedia Home platform (MHP) are available from the industry consortium organized in DVB. Digital penetration in Europe is not yet big however DVB-S has highest percentage compared with DVB-S,T.

UK is the number 1 of dig households covering 42% (28% Sat, 8% C and 6% T). Ireland follows in the ranking with 21 % (19% Sat, 2% T)

4•2   Regulatory aspects relevant to iTV

In the Articles 17, 18 of the Directive 2002/21/EC-European Commission all aspects are regulated. EU member States shall encourage the use of these Standards and promote the free flow of information:

• Providers of it services shall be encouraged to use open APIs.

• Manufacturers of enhanced it receivers shall comply with open APIs in accordance with min. requirements of all relevant standards.

4•3   General recommendations and conclusions from CENLEC (European Norms on Electronics)

Four areas for additional standardization are considered:
• Functional receiver specs
• Presentation engines
• Application Program Interface
• Service Interface

4•4   Relevant facts &developments on Terrestrial, Cable and Satellite delivery

Terrestrial delivery
EICTA E-BOOK T

This book is based on inputs from DTG/UK, NORDIG and DigiTag/Europe. It includes Free-air- (FtA) and Pay TV scenarios by using CI (Common Interface). Ongoing work will cover also iTV in an updated E-Book. The German AG-DVB-T (Action Group) on Terrestrial has worked out DVB-T min requirements for hardware and software update [1].

NORDIG:

The NORDIG II specs are covering 4 profiles: Basic, enhanced, enhanced interactive, Internet access based on MHP API.

D-BOOK /UK:

This book includes required and optional features. Under development is the I-DTG book to cover IP-TV (Internet Protocol).

Cable delivery
EICTA E-Book C

The framework is provided by the E-Book T; two groups are creating specifications: this is the RF- and SI- group. It is assumed that the RF group ERFC, chaired by Sharp will finish the work by mid 2004.

ERFC addresses all parameters for the BIM (Broadcast Interface Module) and the OOM (Out of Band Module) covering the return channel matters.

NORDIG Cable

The consortium has defined the Unified Cable specs [2]. Finland also a member of the NORDIG group has set up additional requirements for the "Free to Cable and Pay TV. These define the use of a specific CA system, called CONNAX, which is compulsory for manufacturers to

compete in an open market.

To date there are 8 different Brands with 10 models competing in the Finnish market.

ECCA (European Cable Communication Association

Commercial requirements [3] were presented to the EICTA. This paper outlines requirements for a Low-end Digital receiver of a "Digital Cable-Media Set Top Box". Hardware, Software needs are described in a loose form and linked to a sales price of 100.- Euros

The EICTA RF group has entered discussions with ECCA to convince them to open up their "walled garden policy".

Satellite delivery

All original efforts were made by Satellite operators, also the generic requirements.

So far, no details are available for iTV on the basis of Free-to-air.

Conclusions

Dig. Video Broadcast penetration is increasing rapidly, especially the dig. Satellite service delivery is occurring at a breath-taking pace, because of the huge cost savings for transponders.

DVB-T will get a real push after the Stockholm frequency planning Conference in 2006 and the start of the switch-off of analogue services. Portable indoor reception will trigger a huge market.

DVB-C will only advance if common specification platform is being established, allowing all manufacturers to deliver receivers. ECCA -EICTA co operation should be fostered.

IdTV (integrated dig. TV), iTV receivers will rapidly replace first generation Set Top Boxes, Portable indoor reception are seen to provide a huge market and DVB-H as great potential beyond 2006.

References

[1]　 DVB-T Minimalanforderungen v. 1.0

[2]　 The Cable TV Tuner part of the Nordig Unified specs

[3]　 ECCA commercial requirements for low-end Cable receivers (Draft Version 0.3)

[4]　 ETSI/CENELEC joint Specialist Task Force 255, open meeting Brussels Nov. 03