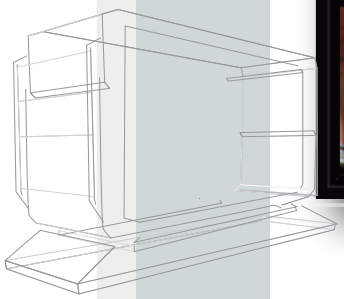
Edition No.34 **June 2010**

DVB-SCENE

Tune in to Digital Convergence



34

Fast Channel Change Solutions

DVB

The Standard for the Digital World

This issue's highlights

- Pay-TV In Latin America
- ASO in Spain
- ABU Digital Symposium
- 3D & The Set-Top Box
- Hybrid Views
- Connected TV
- Market Watch

I AM ENDLESS
POSSIBILITIES
AND THE SATISFACTION OF EFFORTLESSLY BRINGING
ALL YOUR HOME ENTERTAINMENT TO YOUR TV
I AM INTERNET
ON YOUR TV
AND THE JOY OF VIEWING THOUSANDS OF VIDEOS
WHILE CHATTING
WITH FRIENDS ON YOUR FAVOURITE SOCIAL NETWORK
I AM WIRELESSLY
CONNECTED
TO YOUR PC AND YOUR MOBILE
AS YOU SHOW OFF YOUR FAMILY PHOTOS
I AM THE LATEST IN
ENTERTAINMENT
TECHNOLOGY USER-FRIENDLY AND EASY TO DEPLOY
I AM THE OPTIMIZED PLATFORM
READY NOW TO ROLL-OUT SERVICES THAT WILL BE INVENTED TOMORROW
I AM HYBRID PAY-TV
MADE SIMPLE AND RELIABLE

I AM MORE THAN A SET-TOP BOX
I AM INNOVATION. BY ADB.

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TREND SPOTTING

A Word From The DVB Project Office

Peter Siebert, Executive Director

Those of you who had a chance to visit NAB in Las Vegas can confirm that 3DTV was one of the key themes at the event. The DVB Project is on top of this trend and has already completed the '3D Study Mission Report' (see DVB-SCENE Issue 32). We are now moving full speed ahead with the 3D specification work. The relevant working groups, CM-3DTV for the commercial requirements and TM-3DTV for the technical specification, are working hand in hand. DVB's work will focus on the necessary signalling information for 3D content and provide specifications for 3D subtitles. The two groups are fast at work and are determined to deliver solutions for the first phase of 3D specifications within the year.

Another interesting subject being tackled by the DVB Project is 'channel change time'. We are all aware of the advantages digital television can offer like more choice, higher quality and improved convenience. However, there is one important aspect where analogue television is significantly better and this is channel change time, also known as zapping time. Responsive channel change time is critical for user satisfaction and experience. The DVB Project has picked up on this subject and studied solutions for this problem in the IPTV group. The specification is available now and is pending approval at the next TM meeting in June. For IPTV this new specification will bring back the convenience of zapping times we are used to from analogue television experiences.

The work on 3D and channel change time demonstrates that DVB is not only about modulation schemes. In addition, we are on top of relevant trends and provide solutions for the market which make digital television even more attractive and user-friendly. For me it is one of the unique selling points of DVB that we are listening to the market, trying to identify needs and providing necessary solutions. With this market driven approach DVB technologies are adopted and deployed worldwide.

NEW STANDARDS

TS 102 727 Ver. 1.1.1: Multimedia Home Platform (MHP) Specification 1.2.2 (27/01/10)
TS 102 728 Ver. 1.1.1: Globally Executable MHP (GEM) Specification 1.2.2 (including IPTV)(27/01/10)
TS 102 824 Ver. 1.1.1: Remote Management and Firmware Update System for DVB IPTV Services (Phase 2)(01/02/10)
EN 302 583 Ver. 1.1.2: Framing Structure, channel coding and modulation for Satellite Services to Handheld devices (SH) below 3 GHz (12/02/10)
TS 102 591-1 Ver. 1.3.1: IP Datacast: Content Delivery Protocols (CDP) Implementation Guidelines; Part 1: IP Datacast over DVB-H (16/02/10)
TS 102 591-2 Ver. 1.1.1: IP Datacast: Content Delivery Protocols (CDP) Implementation Guidelines; Part 2: IP Datacast over DVB-SH (16/02/10)
TS 102 005 Ver. 1.4.1:Specification for the use of Video and Audio Coding in DVB services delivered directly over IP protocols (16/03/10)
TS 102 611-1 Ver. 1.3.1: IP Datacast: Implementation Guidelines for Mobility; Part 1: IP Datacast over DVB-H (18/03/10)
TS 102 471 Ver. 1.4.1: IP Datacast over DVB-H: Electronic Service Guide (ESG)(19/03/10)
EN 300 468 Ver. 1.11.1: Specification for Service Information (SI) in DVB systems (07/04/10)
TS 102 539 Ver. 1.3.1: Carriage of Broadband Content Guide (BCG) information over Internet Protocol (IP)(09/04/10)
EN 302 769 Ver. 1.1.1: Frame structure channel coding and modulation for a second generation digital transmission system for cable systems (DVB-C2)(13/04/10)

NEW MEMBERS

Digital Interoperability Forum (DIF) - Trade association comprised of global companies involved in the distribution of paid for content by multiple platforms and devices. DIF's goal is to promote interoperable solutions and to advocate light touch regulation. www.difgroup.eu

GMIT GmbH - Component supplier of head-end technology for digital broadcasting, providing software for mobile and stationary TV. www.gmit-gmbh.de

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SCALE MATTERS

Boom For DVB With Pay-TV In Latin America

Ariel Barlaro, Director, NexTV Latam

A study by independent consultants NexTV Latam shows that DVB-C is spreading rapidly through Latin America and by 2012 will surpass the number of US proprietary digital TV systems for cable, which have been dominant in the region for almost a decade. If we add to that the impressive growth of DVB-S systems, DVB technology is the most popular digital transmission standard in Latin American homes and will remain so in the future. There were 11.1million households receiving DVB compared with 2.5 million for ISDB-T at the end of 2009.

Currently, DVB-T has been selected by three Latin American countries. Nevertheless, pay-TV technologies are not officially regulated, but chosen by each operator, and in that market, where digitalisation is making more rapid progress than in free-to-air TV, DVB is becoming the dominant standard. 25 percent of Latin American homes now have pay-TV and that figure is likely to reach 50 percent over the next five years, which proves the potential and leading position DVB will enjoy in the region.

Latin America began to digitalise cable systems in the mid-90s, with a variant of the ATSC technology. By the end of 2008 there were almost four million US cable technology subscribers in Latin America, whereas DVB-C, which had started installing only two years earlier, already had a total of a million and a half. This great leap forward took place in 2007, with the introduction of DVB-C as the dominant standard for cable in Brazil.

If we include the whole of the pay-TV spectrum, the European digital TV standard reached 7.7 million subscribers by the end of 2008, given that 6.2 million satellite (DTH) subscribers use the DVB-S system.

In 2009, there were 2.4 million DVB-C subscribers and 8.7 million DVB-S subscribers in Latin America, whereas US digital technology subscribers increased to 4.7 million, less than half the DVB figure.

The first DVB-C operator in Latin America was Mexico's Cablemás. Presently, the main Latin American DVB-C operator is Brazil's Net, which has become the continent's leading MSO operator in terms of numbers of subscribers and customer growth.

There are also new DVB-C operators in the Dominican Republic, Venezuela, Argentina, Peru, Chile, Uruguay and other smaller operators in every country. In 2009, over 20 cable operators moved to DVB-C in the region. In 2010 another 20 or 30 new companies are expected to choose DVB-C.

The trend is similar to what has been happening throughout the world. From 2005 on, Asian countries brought in DVB-C on a massive scale and in 2007 there were already 46 million DVB-C subscribers in the world compared with 40 million US cable TV technology subscribers. It is the low cost of set-top boxes (STBs) made in Asia that is one of the reasons for the growth of DVB-C in Latin America. The cable MSOs currently using proprietary US technology are migrating or planning to migrate in the next few years because the cost of STBs is their principal item of CAPEX and they cannot compete in terms of efficiency with the companies that are developing DVB. The best example is Cablevisión in Argentina, the region's second biggest MSO, which is changing over to DVB-C.

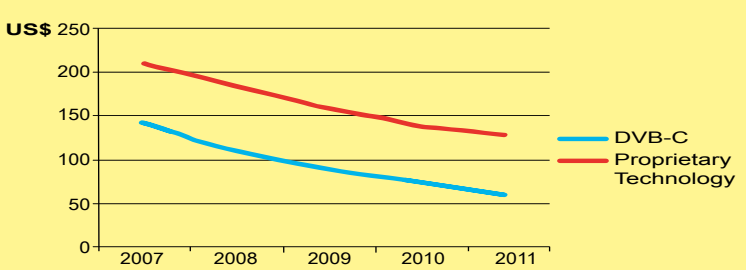
The growth of DVB-C has been remarkable. In 2005 there were practically no operators using the technology in Latin America. Today there is at least one DVB-C system operating in 14 of the 18 Latin American countries. In many cases, however, these are small operators, and 61 percent of subscribers are concentrated in Brazil alone.

The rapid growth of DVB-C among Latin American operators indicates that by 2013 there will be 12 million DVB-C, DVB-MC and DVB-T subscribers for pay-TV. Most of the cable companies that are going digital with DVB-C are the smaller ones and the last to migrate, and therefore by 2013 there will still be almost 15 million analogue cable subscribers and more than half of them will be DVB-C within another five years.

DVB-S technology will continue to be dominant in Latin America. It will rise from 6.2 million at the end of 2008 to 17 million in 2013. If we add DVB-S to DVB-C subscribers (on cable and MMDS) and DVB-T subscribers (for pay-TV), Latin America will have 29.2 million pay-TV subscribers in the DVB environment by 2013, compared with around 11.7 million employing US proprietary systems.

For the full NexTV Latam report on DVB in Latin America, please contact: consulting@nextvlatam.com.

"...the cost of set-top boxes is their principal item of CAPEX and they cannot compete in terms of efficiency with the companies that are developing DVB."



Cost of HD MPEG-4 STBs: DVB vs. US Proprietary Technology

ADIÓS ANALOGUE

Eladio Gutiérrez Montes, President, Impulsa TDT

On 3 April 2010, Spain successfully switched off its analogue television network that had been operational since October 28th, 1956 when the first broadcasts began.

What seemed impossible to many has been accomplished thanks to the efforts of all involved in this technological migration, regardless of their different roles. The coordination between the State Secretariat for Telecommunications and the Information Society, and Impulsa TDT, an association comprised of the public and private broadcasters with nationwide coverage, as well as the main broadcasting operator and network distributor Abertis Telecom was of paramount importance.

Along with the efforts of the stakeholders involved in the audiovisual signal transition and the massive cooperation of the general public, Impulsa TDT believes that the successful implementation of the new technology could be attributed to three main factors:

1. The significant 80 percent coverage inherited from Quiero TV, the failed pay DTT project before the launch of the National Transition Plan.
2. The determination to meet the deadline of April 3rd, 2010, which was stipulated in the National Transition Plan devised in July 2005 for ASO in Spain, despite the sceptical or pessimistic views of some observers.
3. The three phase switch-off process, which allowed for gradual implementation nationwide.

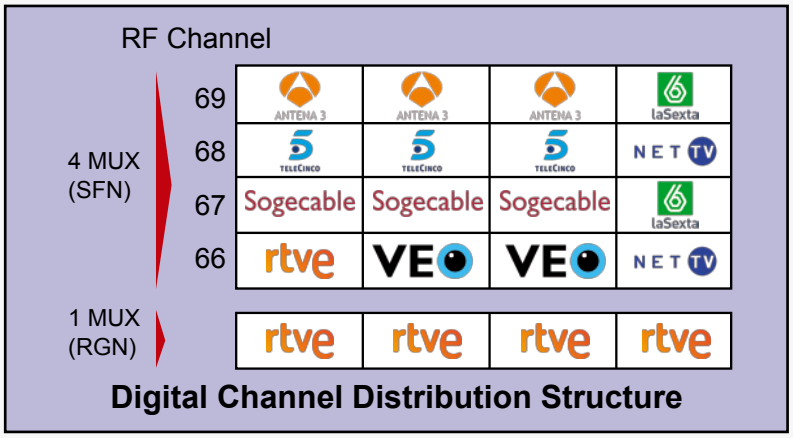
The initial parameters of the technical network built for the Quiero TV launch in early 2000, were not modified: 64 QAM, FEC 2/3 and ¼ guard interval, with a bit rate of 19.91 Mbps.

The chart above shows the digital channels distribution structure, after distributing some multiplex systems to the different broadcasters.

Each multiplex binary capacity is divided among four digital programmes, 20 percent of the total capacity being allocated to interactive applications. However, only the public broadcaster has used this capacity to broadcast several applications using MHP and the penetration of MHP set-top boxes is markedly low.

The national coverage network has been an exceptional case because it included four SFN multiplex channels using frequencies 66 to 69, with a differential signal for TDT implementation creating the most extensive SFN network ever deployed in Europe.

Thanks to this network structure, with over 4,700 transmitters, coverage has been extended to reach almost 99 percent of the population. Likewise, by taking advantage of the signal transport system to the broadcasting centres via satellite, a DTH system has been developed ensuring universal coverage.



Four years and four months after the DTT relaunch in December 2005, the following goals were accomplished

- Coverage: the State Global Network (with regional switching capabilities) - 98.79 percent; the four SFN mux (without regional switching) - 98.36 percent.
- Sales of DTT receivers: more than 31 million devices sold, including STBs, iDTVs and other equipment (DVDs, pen-drive tuners, etc).
- DTT consumption: The chart below shows the vital importance of terrestrial reception for Spanish viewers (percentage of Spanish households that on average access each television distribution system for at least one minute daily).

The three milestones for the progressive and organised execution of the ASO process have been:

Phase 1 - 32 Technical Projects
Development dates: June 30th, 2009 – October 30th, 2009
Population coverage: more than 5 million people

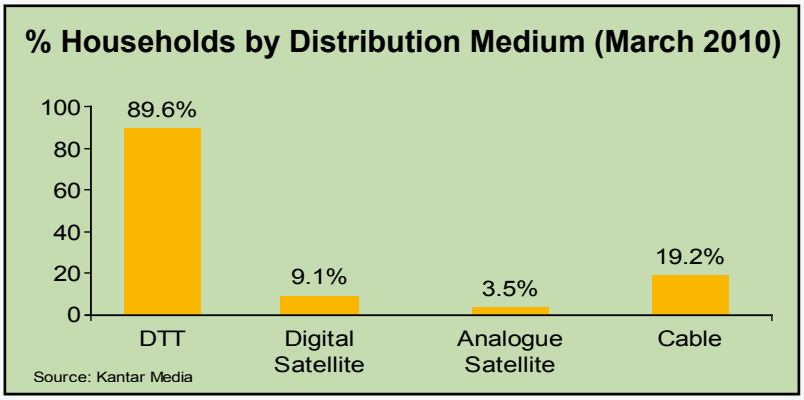
Phase 2 - 25 Technical Projects
Development dates: December 10th, 2009 – January 30th, 2010
Population coverage: more than 8 million people

Phase 3 - 33 Technical Projects
Development date - April 3rd, 2010
Population coverage: more than 31 million people.

It is worth mentioning that the insertion of banners every hour in all the analogue channels was a highly useful information tool to raise awareness among viewers about the proximity of ASO.

After ASO, the digital dividend will allow for the reallocation of the broadcasting channels. By 2015 TV operators will have a full multiplex at their disposal, using new frequencies different from the current ones. This will undoubtedly present a complex process because, among other factors, the LCN (logical channel number) is not implemented in Spain. The plans for the final distribution of channels among the national broadcasters must be ready by January 2015.

It is hoped that the coming changes, derived both from the digital dividend and the launch of high definition, are received by Spanish viewers with the same enthusiasm as they have demonstrated for ASO. This is especially important for a country where terrestrial television is of the utmost importance.



DIGITAL ADVANTAGES

DVB-T2 Debated At ABU Digital Symposium

John Bigeni

The ABU Digital Broadcasting Symposium 2010 was held from 9 – 11 March in Kuala Lumpur, Malaysia. The symposium, which is organised by the Asia-Pacific Broadcasting Union (ABU), is the sixth in a series of highly successful annual events staged by the ABU to help equip radio and television broadcasters with the expertise to plan and manage their digital implementation. The event has now become a very significant event in the region's calendar.

This year's theme was 'Leveraging the Digital Advantage'. The event once again has received an enthusiastic response from the industry, attracting more than 350 participants, including 60 eminent speakers.

The three day conference included 10 workshops and a 40-booth exhibition in which many major industry players exhibited their products and services. In addition, 150 local industry players and university students registered to visit the exhibition. Unfortunately, the timing of the conference clashed with DVB World, which prevented many Europeans from participating.

One workshop in the symposium schedule which has direct relevance to DVB dealt with the new terrestrial standard DVB-T2. This was to discuss the pros and cons of directly leapfrogging into this new standard rather than implementing DVB-T as an intermediate step prior to ASO.

The workshop was well attended and discussions went well over the time limit. Clearly, the subject drew great interest as a number of countries in the region are still at the onset of the final implementation of digital terrestrial broadcasting. Indeed, the creation of the new standard has caused a number of countries to pause and reconsider their implementation strategies.

It was made abundantly clear from the discussions that the new standard has great advantages for countries if it was economically feasible to directly implement the new standard. Such advantages are led by the very significant improvement in payload capabilities and its direct implications on higher spectrum efficiencies.

Other advantages, it was pointed out, included the ability to carry a variety of different services such as mobile, HDTV and other types of services

John Bigeni

within the same transmission package because of the physical layer pipe structure of the standard. During the debate it was pointed out that the other significant benefit of leapfrogging directly to DVB-T2, if digital conversion had not commenced, is there will not be a legacy situation created in going from DVB-T to DVB-T2.

The big dilemma seems to pivot on the price of decoders. On the one hand, prices of DVB-T decoders have now been reduced to approaching 10 USD (FOB) and have very much become a consumable item. These are now readily available from many suppliers and even sold at supermarkets. Prices might even get lower as a result of huge markets arising from many countries now facing ASO. Such a situation will clearly benefit countries opting for the DVB-T option, ensuring high affordability, resulting in rapid penetration and possibly a shorter dual analogue/digital period. This will have benefits in having an earlier than normal ASO and quicker reaping of the digital dividend benefits. Such a scenario might well be seen as attractive in countries where disposable incomes are low and decoder affordability is a problem. This ensures at least that the benefits that accrue in providing digital transmissions are available to all levels of the community.

However, the option of leapfrogging has benefits but at a cost of more expensive decoders. Though it was pointed out that DVB-T2 decoders are already available to buy below 200 GBP. It was projected that within 12 months these costs will be below 100 GBP (at time of writing prices are below 100 GBP). DVB-T2 is now an established standard having been implemented in the UK, and other countries have declared their intentions to follow suit, which may well prove these projections correct.

In the circumstances, therefore, it would seem that if the digital rollout is not immediate but projected some 1 – 2 years away then leapfrogging to DVB-T2 begins to look a very attractive option.

The conclusion from the workshop was that there really is no simple single answer and which way a country should go depends on many factors. However, clearly, as time goes on DVB-T2 becomes a very real option – one which really results in many benefits for the consumer, the broadcaster and indeed the government. My belief is that we are likely to see some very early decisions to adopt this standard by a number of countries in the region.

CHANGE THE CHANNEL (FAST PLEASE) !

Tom Van Caenegem , TM-IPI FCC TF Chair, Lead Technologist in Wireline Networks CTO, Alcatel-Lucent
Muriel Deschanel, TM-IPI Chair, Standards Program Manager at Microsoft

It is a fact that more and more people watch broadcast TV content time-shifted, using (network) DVR functionality. However, a lot of people still watch television the very moment it is 'aired'. This is because of the specific nature of some programmes (for example live sporting events), but also because old habits don't die fast (or never die at all), and for some it's simply the preferred way of watching TV; in this case, changing channels (i.e. switching content) needs to be fast and convenient. However, fast is not always fast enough; channel change times in the order of 2 to 4 seconds are not that uncommon and can easily cause frustration.

"...this process results in a fast and flawless channel change experience."

Why is (normal) channel change slow?

(Large) channel change response times can be attributed to various factors, but the main two contributors are:

- Waiting for a Random Access Point (RAP): video content can be encoded efficiently by taking advantage of the dependencies of picture frames with respect to previous or subsequent picture frames in the video stream. This means that a receiver must wait for what is called an intra-encoded picture (I-picture) or RAP before the decoder can start processing. The periodicity of the RAPs in the video stream will hence impact the channel change response time. A shorter period will result in faster channel change and also reduces the visual impact when a packet is lost or corrupted. However, the price to pay here is the larger bit rate required when RAPs are close to one another, as the code size of I-pictures is typically quite large.
- Video Buffer filling time at the receiver: before a video stream (starting with a RAP) gets decoded, it is first buffered. There is a trade-off to be considered between video quality and the (maximum) amount of buffering required at the receiver: if the maximal allowed buffer is very small (small delay), then the video quality will suffer, especially in fast moving scenes. Note that receiver buffering is also required to compensate for jitter and to allow for packet loss repair.

Waiting for a RAP and video buffering time together easily exceeds two seconds. Other factors impacting channel change time are in general smaller and attributed to CAS/DRM, packet loss repair, multicast switching time (IPTV), STB signal processing delays, etc.

Making channel change fast

In an IPTV linear TV service, referred to as Live Media Broadcast (LMB), channels are delivered across an IP access network typically by means of IP Multicast. In the case of 'normal' channel change, an IPTV end terminal (or HNED for Home Network End Device) joins (and leaves) the IP Multicast streams using the IGMP protocol, after which the waiting for a RAP kicks-in and the buffer must be filled as explained above. DVB-IPTV specifies two Fast Channel change (FCC) solutions which address these two delay factors.

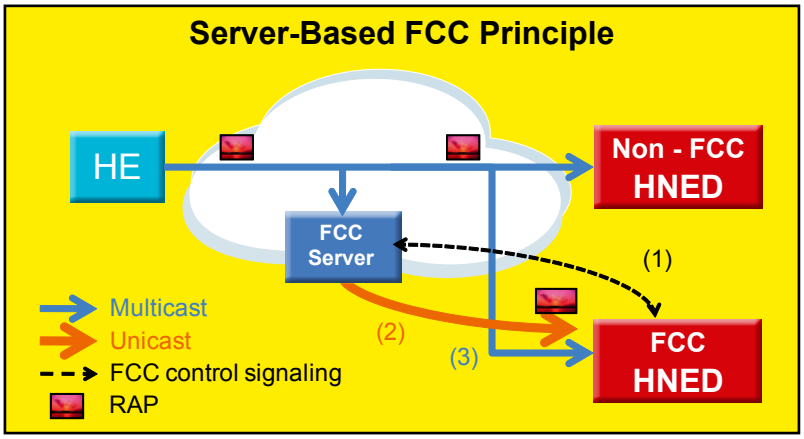
The server-based FCC solution leverages the RTP/RTCP protocol solution that has been recently specified in the IETF AVT Work Group and specifically targets IPTV deployments: when a person zaps to a new channel, after leaving the previous channel, the HNED requests a unicast stream from the FCC server. This server receives and caches for a limited time the IP multicast streams, and hence the unicast stream can start with a RAP from the recent past. The data in the unicast stream can be burst relative to the normal streaming rate of the channel, reducing buffer filling time but also allowing the terminal to catch-up again with the multicast, which the terminal will join when being instructed to do so by the FCC server. To the end-user, this process results in a fast (sub-second) and flawless channel change experience.

The companion stream FCC solution can be deployed both in broadcast (non-IPTV) and broadband deployments, and can result in similar response time reduction as the server-based FCC solution but with a so-called transition period: for a limited amount of time (in the order of a few seconds), the video will first be displayed at a lower quality. What happens behind the scene is that upon channel change, the terminal will join not only the normal channel stream, but also a companion stream. This is a broadcast/multicast stream sourced by the head-end with identical content as carried in the normal channel, but encoded with a much higher RAP frequency. Because of the lower quality encoding, it can be streamed at a lower bit rate compared to the normal quality channel.

Both FCC solutions require a (similar) additional delta bandwidth for a limited time (a few seconds) compared to a non FCC-enabled LMB service. The companion stream solution operating as a serverless FCC scheme provides better scalability, whereas the server-based FCC solution delivers the best Quality of Experience (fast channel change and no transition period).

So, next time you watch (IP)TV and you realise you are actually waiting for the new selected channel to pop-up on your TV display, do ask your (IPTV) service provider for a FCC upgrade! The FCC technology is out there!

The two DVB-IPTV FCC options will be part of the V1.5 release of the DVB-IPTV handbook scheduled for publication at the end of 2010.



3D & THE STB

Standardisation Of The Broadcast Signal From The Set-Top Box Perspective

Kevin Murray, System Architect, New Initiatives, NDS

Today, broadcasters are using their existing HD infrastructures to provide 3D demonstrations, and in some cases to even launch stereoscopic 3D television (S3DTV) services. The question then is whether there is in fact a need to introduce further standardisation to the set-top box to support S3DTV? Put simply, the STB (and its IDTV equivalent) is an active part of the content chain which performs a range of functions such as overlay graphics, video manipulation and trick modes. And to perform all this correctly and seamlessly, the STB requires additional information - hence the need for standardisation.

The first thing the STB needs to be aware of is the format of the video.

Photos Courtesy ITV Studios, 'Headcases'. Executive Producer Saurabh Kakkar

But why? Surely it can just pass the video straight through to the display? There are two reasons. Firstly, to enable the correct format signalling to be communicated to the display using the recent HDMI extensions, enabling automatic detection – thus removing the need for the viewer to continually reach for the remote to switch between 2D and 3D modes on their television. Secondly, to allow the STB to support and correctly position overlay graphics as used by subtitles and information banners.

It is important that this information is delivered in parallel as the video signal is generally manipulated by the display in a way that can render overlay graphics unwatchable. The side-by-side format used in pictures 1 to 4 shows one example of the problem. In the first image a subtitle is placed over the video without adjusting for the underlying side-by-side format. The display manipulation results in the next two images (pictures 2 and 3) that show what is seen by the left and right eyes, and an approximation of the combined result is shown in the picture 4. Clearly, if the STB is aware of the format, it can then generate the graphics so they are readable after manipulation.

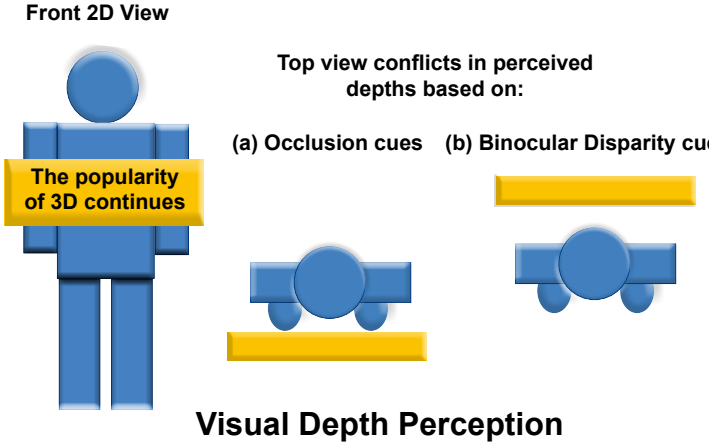
Standardising a minimum set of mandatory formats, just as HDMI has done, is essential. Each extra format represents additional complexities for the STB and therefore extra costs. Should the formats not match those defined as mandatory by HDMI, format conversion may become a requirement of the STB, and whilst some format conversions are simple, others are not. S3DTV brings the new dimension of depth, so what happens if graphics are correctly applied, but without awareness of the depth? Something quite unpleasant! There are numerous depth cues in S3DTV, but two important ones are binocular disparity – the difference between the views in the left and right eyes – and occlusion – objects obscuring others in a scene. With a simplistic graphics overlay we can produce conflicting depth cues: where binocular disparity tells us, for instance, that the graphics are behind something, but the occlusion tells us that the graphics are in front. The illustration below shows the two conflicting depth positions that the brain must resolve. This conflict destroys the stereoscopic effect and can induce headaches.

Preventing this conflict requires the provision of depth information as part of the overall broadcast data flow. Ideally, this would constitute one, or a small

> **"...format conversion may become a requirement of the STB..."**

number of values that provide a safe depth at which graphics can be placed, and is usable for any graphic the STB needs to generate. Whilst subtitles are the most obvious use of this information other graphics can benefit too, for instance channel information banners that often appear during channel change.

And what of future developments in 3D, when we may well see improvements in the signal delivered to the viewer, such as higher resolutions, better frame rates or more than just stereoscopic views? Will they render the above areas obsolete? The same fundamental problems will exist, these broadcast signalling extensions will still be required – they will be as applicable in the long term as they are in the short term.



Visual Depth Perception

HYBRID VIEW

Broadcast + IPTV + OTT + Home Networking = Hybrid

Paul Bristow, VP of Strategy, Middleware & Consumer Experience, ADB

In the pay-TV world, we're clearly doing something right. For a long time now the number of pay-TV subscribers has been going up and up, with today, more than 57 percent of the world's TV viewers choosing to pay for television. At the same time, the industry has also been doing a great job of rolling out ever faster broadband, making it easier to do internet video. The results? Dozens of devices and hundreds of online services competing for the attention of TV viewers. We could take this as a threat but actually we should leap up and down in delight. Viewers are demanding more TV and we know how to deliver TV.

But we as an industry still enjoy making things hard. We waste so much time arguing about technologies that we seem to have entirely forgotten that TV is about entertainment! Some spend their energy on promoting the technology that will be the easiest to integrate while we should all focus on making products easy to use. I have never heard a consumer say "I'll buy this product because it was easy for the engineers to make".

What about standardising on HTML? We seem to forget that HTML is more an ever-changing ideal than a specification. Look at how often your browser gets updated on your PC. HTML is evolving with the coming of HTML5 and the embattled video tag. Once (if!) this settles down, we might have a chance, but right now, trying to define 'internet TV' is a waste of time and resources.

This means not only sharing your personal content throughout the home – including to your TV - but also sharing your TV throughout your home and beyond. Pay-TV is very strong on the first TV set. We believe that Hybrid will drive pay-TV penetration to the 2nd, 3rd and 4th sets. No one, when given the choice, decides "I will have a second-rate experience on my second TV".

But as we add more services, it's easy to forget the basics!

There is no reason it should take much longer to zap or to simply turn on the TV than in the old analogue TV days – and no one is ready to accept a reboot during a football match!

Consumers are sometimes very simple in their approach – they want everything and they want it precisely when they need it, in a straightforward reliable manner. They don't want to hear about DRM, CA, MPEG-4, VOD, DIVX, HTML, HBBTV or any of our industry acronyms we seem so fond of. And if you think people are starting to get fed up with zapping slowly or crawling through a badly implemented EPG, just wait until you see how they react to an over-the-top VOD portal per channel!

To make the consumer TV experience work, all complexity must be hidden. People want the simplicity, reliability and responsiveness of analogue TV. They want to be entertained now, not spend hours searching for content. We have to make this easy for the consumer – and if that does not mean easy for the device manufacturers then hard luck. It's our job to take care of this complexity, for both consumers and pay-TV operators.

"We have to make this easy for the consumer – and if that does not mean easy for the device manufacturers then hard luck."

So let's talk about something other than technology. Viewers!

Despite all the new technology, viewers haven't really changed their TV habits. We think it's because the industry isn't making it easy for them.

So what can we do about this?

We need to meet the consumers on their own terms – letting them think about content and where they want to watch or listen to it. It's crystal clear. The future of pay-TV is a consumer view of Hybrid, which equals Broadcast + IPTV + OTT + Home Networking.

With this view of Hybrid, the opportunities for pay-TV operators to bring new content and services are immense. When you connect your set-top box to broadband, you also connect it into your home network.

To deliver this, you need a sustainable business model that supports the realities of Hybrid. Hybrid technology is complex from a software perspective. It really matters how the entire set-top box software is managed, ensuring it's ready for the growing range of tasks. The pay-TV business model supports continuous software upgrades to deploy continuous innovation.

TV/web content convergence is radically changing the consumer TV experience, putting consumers back in control of their entertainment. The challenge now is to deliver this enhanced TV experience.

CABLE VISION

DVB-C2 Prepares For Take-Off

Christoph Schaaf, Kabel Deutschland & Chairman of DVB TM-C2 Group

Following the approval of the DVB-C2 specification by the DVB Steering Board in April 2009, the TM-C2 Ad Hoc Group focused on the development of the DVB-C2 Implementation Guidelines. While the DVB-C2 technical specification is limited to uniquely defining all building blocks and protocols of this new digital cable transmission system, the DVB-C2 Implementation Guidelines details information on the background, the motivation and the reasons why certain technologies were chosen. In addition, it explains the benefits the DVB-C2 system may provide future users. Furthermore, the Guidelines address the implementation issues of the DVB-C2 modulator and the cost sensitive corresponding demodulator unit of the CPE.

The work on the drafting of the Guidelines was finalised in January and then approved by the DVB Technical Module later that same month. It was approved by the DVB Steering Board in February and was published by ETSI as a standard (EN 302 769) on 13th April. Following the opening overview of the basic technologies used in DVB-C2, the Guidelines describe the anatomy of the DVB-C2 signal (Section 5), its major building blocks and its structure. The next section outlines the criteria, guidance and recommendations for the choice of the relevant basic parameters of the DVB-C2 system. Next comes a focus on input processing/multiplexing and Section 8 introduces, in detail, the technical aspects of the implementation of the DVB-C2 modulator, including coding examples for the L1 signalling. In Section 9, the impact of a DVB-C2 signal on a cable network is examined and contains important contributions from the ReDeSign research project. This cooperation was possible due to a liaison agreement. ReDeSign investigated the optimisation of Hybrid Fibre Coax cable infrastructures. As part of the research they allocated resources to the investigation of the integration of DVB-C2 into existing network infrastructures and today's typical signal configurations. The complementary aspects of a DVB-C2 demodulator are given in Section 10, which details the relevant processes for a demodulator to synchronise on a DVB-C2 signal and to tune to a targeted service. It also introduces proposals for the implementation for certain demodulator functionalities. Section 11 of the Guidelines introduces performance figures for the DVB-C2 system based on simulations using the open DVB-C2 simulation platform. The final section looks at scenarios of future applications for DVB-C2. Several examples explain the wide range of possible future applications for the DVB-C2 system.

In parallel to the drafting of the Implementation Guidelines, the important Validation and Verification work continued within the DVB-C2 project. A Task Group of the DVB-C2 Technical Module established an open DVB-C2 simulation platform and defined a set of test cases, starting from simple signal configuration to complex ones with multiple PLPs and data slices. The work on the first test cases has been completed with contributions from four DVB partners. The interoperability of the contributions of the different DVB-C2 building blocks proves that those partners have interpreted the specification in the same way and that the specification elements relevant for the tests are unambiguous.

At last year's IFA in Berlin, a one-day DVB-C2 seminar for implementers was held. 16 experts from the TM-C2 Group gave first hand information to more than 60 interested international participants. Due to the overwhelming response for the event, the organisers decided to make the content of the presentations available as a book that will be published shortly.

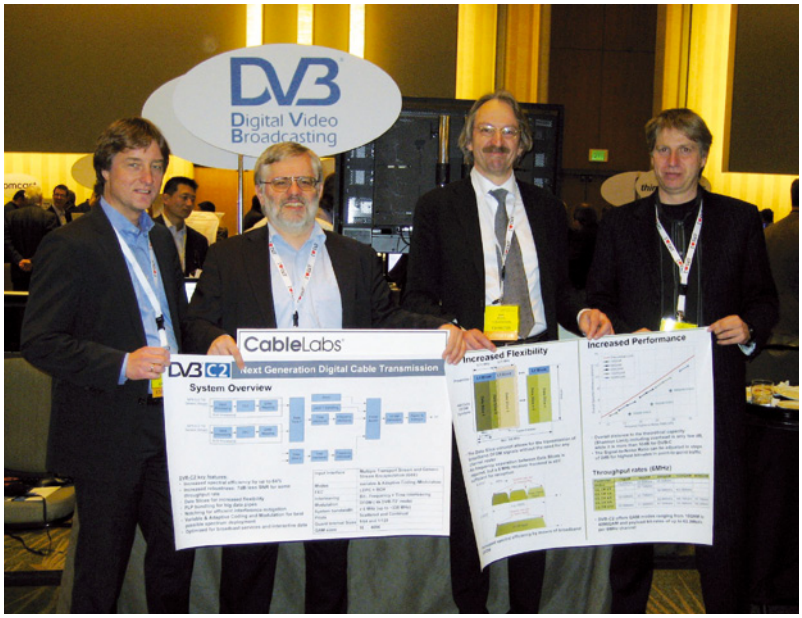
DVB experts were invited by CableLabs to introduce DVB-C2 at the exhibition of the their Winter Conference held in Denver, Colorado in February. In addition, DVB had the opportunity to introduce the second-generation cable transmission system to experts from CableLabs and the US cable industry at a dedicated workshop.

In March, the Cable Europe Congress in Brussels hosted a dedicated session to DVB-C2 as did the DVB World Conference in Lisbon.

A real highlight of the ANGA Cable exhibition in May in Cologne was the first public presentation of DVB-C2 modulation and demodulation hardware on the ReDeSign booth. A paper on DVB-C2 was also given at the event's conference.

DVB-C2 will have a presence on the DVB stand later this year at IBC.

The DVB-C2 specification is published by DVB as BlueBook A138 and the DVB-C2 Implementation Guidelines as BlueBook A147 and are available for download from the DVB website.



DVB Delegation at CableLabs Winter Conference: (L-R) Dirk Jaeger, Christoph Schaaf, Bart Brusse and Lothar Stadelmeier.

In My Opinion – John Moulding

EVERYONE'S A WINNER WITH CONNECTED TV

Videonet Editor, John Moulding Looks at the Opportunities for Broadcasters, Online Content Providers and CE Vendors in the Connected TV Market and Ponders What It Means for Pay-TV.

Connected TV looks like a big opportunity for nearly everyone in the content-to-consumer value chain – with only pay-TV platform operators faced with any real threat. Traditional broadcasters could be the biggest winners because, over time, their catch-up TV services can be made available on every TV set without reference to platform operators.

In an increasingly on-demand world, broadcasters looked exposed a few years ago (relying on pay-TV operators if they wanted their content available on-demand to the TV). Since then, broadband speeds have increased and streaming technology has improved, and now there is a proliferation of devices that enable over-the-top content to be displayed on the TV screen (e.g. games consoles, Blu-ray players, STBs and Connected TV sets). Broadcasters can also generate enhanced interactive services – adding a completely new dimension to the 'Red Button' concept by linking viewers to internet-hosted applications and services. Connected TV could give commercial broadcasters greater control of their advertising destiny. In the online on-demand environment, they could perform their own advertising insertion and therefore replace national adverts and offer greater demographic targeting.

For the CE vendors, Connected TV functionality could accelerate the television replacement cycle. 3DTV will appeal to the early adopters but YouTube and Netflix on the television screen, along with local broadcaster catch-up services, would appeal to a wider demographic at a much lower price point.

Some CE vendors are also eyeing the opportunity to become entertainment service providers. The most obvious example is Sony, which is making premium video available through its PlayStation Network for games consoles and is now doing the same on connected televisions and other devices. Having demonstrated its ability to sustain an ongoing customer relationship with gamers, Sony looks well placed to create a new breed of Connected TV service provider.

Offering a good (and it has to be good) video entertainment portal must be a powerful brand building exercise, as well. And once you move beyond the games console and onto the television, the demographic opens up. Television is the ultimate mass-market device. Online content providers who have been confined to PC delivery can reach a whole new audience, too. Taking a rather lazy example, if you have a sailing channel on the internet, it could get noticed by a new, older audience that is not interested in watching video on the computer. For online VOD providers, there is an obvious opportunity to take market share from the pay-TV VOD offers by providing better choice or lower prices, if this can be achieved.

For pay-TV providers, the situation is more complex. They could potentially lose eyeballs for a number of reasons. First, TV set makers can offer a user guide that is the gateway to their connected entertainment portal, and this could compete with the pay-TV programme guide for attention. Second, there may be good content, including special interest programming that is not in the pay-TV offer but is in the connected TV portal. Third, there could be lots of competitive VOD services where before platform operators had a VOD monopoly on the TV screen.

Pay-TV operators with strong multiplatform strategies will ensure their subscription content is available on the PC and mobiles and once the content is online (perhaps with their own 'player') it is a short step to the connected television set (over-the-top via the games console, Blu-ray player, etc.)

As content owners themselves (often with compelling premium channels) they could take their services into more homes, including competitor pay-TV homes, via the TV.

But as a platform operator, pay-TV companies will need to work harder to keep the attention of subscribers and remain the primary aggregator of entertainment content in their households. There are a range of ways this might be possible, including opening up their programme guide to online content partners and so putting the content people want in one place. They can also open up the TV screen to content stored elsewhere in a home network and they can make sure that they are better than anyone else at helping consumers discover the content they are looking for.

> **"Connected TV could give commercial broadcasters greater control of their advertising destiny."**

Videonet explores the business and technology challenges faced by the TV industry as it introduces more high definition and on-demand content and evolves towards a multi-platform and connected TV experience. The online magazine manages three important LinkedIn Groups including Connected TV (650+ members). Its regular e-newsletters, e-magazines and special reports are free.
More information can be found at www.v-net.tv

IN CASE YOU MISSED IT...
HIGHLIGHTS FROM DVB WORLD

This year's annual DVB World Conference was held in Lisbon. The Congress Centre was a buzz for the three days of lively presentations and discussion on all things DVB and other developments taking place in the broadcasting world. There follows some extracts taken from David Wood's excellent DVB World Blog. The full unabridged version of the blog is available on: http://dvbworld.wordpress.com.

BSkyB's Brian Lenz (left) outlined the broadcaster's strategy in his Keynote Address. The core to the strategy is 'hybrid'..the beginning of a great set of opportunties. Also, every product they sell will be an 'HD' device. A new HD EPG has been deisgned. And yes, Brian did get to 3DTV. Will 3DTV be one of the next 'big things'? They believe so.

RAI's Alberto Morello explained the concept that a single broadcast system might serve to provide all types of media? There is currently a call for proposals for technology for DVB-NGH. The tools of the new system which may allow the system to be 'universal' include such elements as the SVC coding system of MPEG-4 and the use of multiple antennas. Alberto's conclusion was that with NGH we have a real chance of a 'breakthrough' system, which will serve a universal market.

Ben Keen (left) from the venerable Screen Digest, took participants to the world of broadband as a potential pipe for taking media into the home. He explained that long length online video is increasingly dominated by broadcasters, which may be good news for professional programme makers. All major TV sets will have an internet connection, and this will have a dramatic effect on the way broadband is received. Though games consoles may even be bigger than connected TVs (hybrids) at bringing broadband video into the home. These may be the 'Trojan horse' for video on demand.

Ulrich Reimers dared to ask the question "can the next generation mobile phone system, LTE, be used for broadcast services? " Ulrich explained that a lot of the LTE elements come from DVB systems. Ulrich calculated that DVB-T2 is about 50 percent more bit rate efficient than LTE and that the old idea, MBMS, was never used in practice because it is not 'broadcast friendly'. The new variant, MBSFN, is better but still not as efficient as DVB-T2. Ulrich concluded that although LTE is more efficient than UMTS, as a means of providing 'broadcast' it is much less efficient than DVB systems, and cannot be used for high quality video delivery.

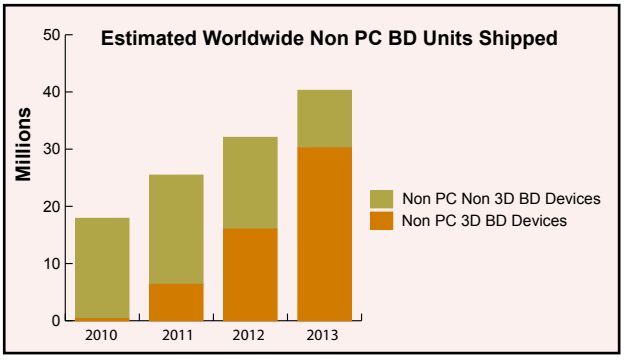
David Wood (left) provided an excellent blog throughout the conference, only taking time out to give his presentation in his role as chairman of the DVB Commercial Module on 3DTV. He told the audience to think 'Frame Compatible' and 'Service Compatible' and said that the 3DTV commercial requirements seem likely to fall into two major groups. The first being pay-TV, whose main concern is to preserve the use of existing set-top boxes in the 3DTV environment. A modest software up-grade if needed would be OK. And the second is the free-to-air group, whose main concern is for existing receivers to be able to watch a 2D version without needing an additional broadcast channel for a simulcast.

Ken McCann (left) explained the history of improving video compression efficiency. He believes we will need more efficient video compression in a future media, and outlined the work of the MPEG/JVT to achieve it. The target is a 'substantial' improvement. Video resolution up to 8K by 4K for a UHDTV world is called for. Tools in a first round suggested an improvement of about 20 percent. A second round is now underway for more tools. These have been evaluated by light subjective evaluations and objective evaluations, and improvements of about 20-30 percent have been noted. Formal subjective evaluations are now being made.

DVB WORLD PARTY WITH DVB RACING

VERSIONS OF 3D

MOORE ANALYSIS



Blu-ray 3DTV Quality: Can it Foster a New Broadcast Infrastructure?

Because there are two ways in which early adopters of 3DTV will get their programming – from 3D Blu-ray prerecorded discs or their DTH satellite or other pay-TV providers – there will be the inevitable quality comparison between the two delivery systems. Broadcasters/pay-TV service operators – quite content to try out 3DTV without buying new head-end equipment and set-top boxes – will get to run the new services by their customers without gambling a big chunk of the operating budgets on an unproven technology.

By using the frame compatible delivery system, broadcasters have the luxury of measuring interest before making a costly technical upgrade.

The packaged media method, however, will give consumers a higher resolution experience because content will be encoded and decoded in MVC, a new implementation of MPEG-4 AVC. Will the experience of viewing full HD resolution for both eyes create dissatisfaction among consumers when viewing lower-resolution programmes delivered in the frame-compatible system over broadcast networks? Time will tell. The benefits consumers will realise from live and broadcast-delivered 3D programmes may be great enough to compensate for the lack of full HD resolution. And if source material stamped on a 3D Blu-ray disc is simply a conversion of a 2D movie to 3D, other subjective measures of quality are likely to be compromised even if resolution isn't.

DTC forecasts that there will be plenty of 3D Blu-ray devices for consumers to try out the highest-resolution of 3DTV in the next few years (assuming they have a 3DTV display). Shipments will be modest in 2010 but will climb rapidly to an estimated 41 million in 2014. The BD players able to render 3D (Profile 5 BD players) will also provide other advanced features, such as enhanced internet and interactive features and will be marketed as the most technically advanced players regardless of their 3D capabilities.

If pay-TV providers can generate enough extra business and/or retain customers with the current version of broadcast 3DTV, vendors can rule out significant production and head-end equipment and STB orders to build new 3DTV infrastructure. But the ability of consumers to snack on different 3DTV experiences could very well set up a future where broadcast delivered 3DTV will have to lay out the full high-definition feast.

Myra Moore is chief analyst for Digital Tech Consulting (DTC), a market research firm that tracks and analyses the consumer digital video marketplace. More information on the company and its latest research on TV receivers, DVB-T devices, and other digital video activity is available at www.dtcreports.com.

MARKET WATCH

LG LX9900 DVB-T2 IDTV

LG has launched the 55", full LED Infinia TV, with built-in DVB-T2 tuner for the UK Market. The new TV is part of its LX9900 series that provides access to the UK's recently launched Freeview HD free-to-air service. It has an ultra slim single layer design and a range of eco friendly features. It enables access to internet content such as YouTube as well as being 3D ready. **www.lg.com**

Advanced Digital Broadcast (ADB) recently announced that it will soon introduce its i-CAN Easy HD DVB-T2 receiver in the UK. The device, the company's first UK consumer product, will be available in stores in time for the football World Cup and will enable UK TV viewers to watch over 50 standard and high definition television channels, without the need for a pay TV subscription, as well as accessing catch-up TV applications such as the BBC i-Player. **www.adbglobal.com**

ADB i-CAN Easy HD DVB-T2 Receiver

ROVER Instrument's new touchscreen DIGICUBE meter (4-2250 MHz) masters measurement of digital DVB–S&S2, DVB–T&H, DVB-C signals. Thanks to advanced software, a generous touch screen display (6.5" 16:9 LED TFT), icons, graphic symbols and intuitive menus, it allows easy navigation and direct access to: MER, BER, PER, MARG, fast spectrums, constellations and real time echo and pre-echo measurements. The meter is very light (2 Kg), rainproof and scratchproof, with an excellent battery autonomy. **www.roverinstruments.com**

ROVER Instrument's DIGICUBE

Albis Technologies announced the availability of SceneGate - its next generation set-top box portfolio for enhanced HD picture quality while delivering on-demand, interactive and linear TV services. The STBs enable service differentiation and is designed for new IPTV service providers introducing service offerings to their customers, or service providers introducing interactive IP based services while leveraging their existing digital broadcasting technology. The proven hardware and software quality reduces operational costs and customer churn, making services more reliable and profitable. **www.albistechnologies.com**

DekTec has introduced the DTA-2160 adapter for PCI Express bus. The card supports Gigabit Ethernet and three bi-directional DVB-ASI channels. The GigE port operates like any standard network interface card, while it adds hardware support for jitter-free transmission and reception of many parallel TS over IP streams. The API for the DTA-2160 lets custom applications use the TS-over-IP port in exactly the same way as ASI ports. **www.dektec.com**

DekTec DTA-2160 Adapter

TechniSat´s DIGIT HD4 CX CSP is a DVB-C receiver with embedded Conax CAS and chipset pairing function, ready for HD and SD reception (MPEG2/ MPEG-4). The STB has a PVR function for recording to external devices. The receiver has already been customised for various European cable operators and will be launched in a customised version also for the Luxembourgish cable platform Imagine with their new HD-bouquet. **www.technisat.com**

TechniSat´s DIGIT HD4 CX CSP

Latens, the software conditional access and middleware specialist, has updated its ECO solution for pay-TV operators. Its ECO middleware with pre-integrated software-only conditional access brings true multimedia networking to the home with key features such as OTT TV services, DVR, remote DVR, and Home Networking. The IPTV middleware platform now offers enhancements such as alpha-blending graphics over live TV, advanced third party applications and greater User Interface customisation and configuration options for operators. **ww.latens.com**

Latens ECO Solution

Humax HD-FOX T2 DVB-T2 Receiver

Aimed at the UK's DVB-T2 market, the **Humax** HD-FOX T2 enables viewers to immerse themselves in high definition content with upscaling to 1080p full HD for up to five times more detail than standard definition, plus crystal clear sound from Dolby. The compact box also gives access to up to 50 standard definition digital TV channels from UK's Freeview HD free-to-air platform and offers home networking, content sharing and interactive TV services. **www.humaxdigital.com/uk**

Silicon Laboratories Si2161 & Si2165 Single-Chip Demodulators

Silicon Laboratories' Si2161 and Si2165 digital video demodulators provide low-power, high-performance demodulator solutions for DVB-T, DVB-C and fixed-reception DVB-H applications. The single-chip demodulators are ideal for equipment receiving digital terrestrial and/or cable services including integrated digital televisions, free-to-air or pay-TV set-top boxes, PC-TV add-on cards and DVD/HDD personal video recorders. Both products operate natively in the widely used DVB-T terrestrial broadcast mode. The Si2165 adds the DVB-C demodulator mode for unscrambled and pay-TV cable services. **www.silabs.com**

Newtec Azimuth With DualFlow

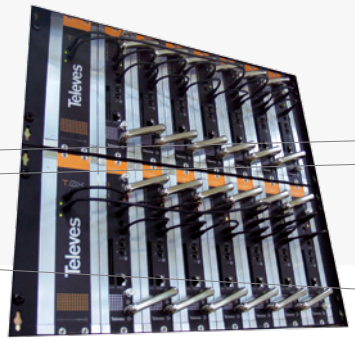
Newtec's DualFlow feature for its Azimuth product line enables a progressive migration from a traditional ASI video satellite transmission network to an IP infrastructure by providing both IP and ASI interfaces. The second advantage is its ability to transport IP content over a satellite link. Broadcasters can transport IP over satellite and transmit traditional MPEG signals or a combination of both IP and MPEG on the same carrier. When used on a modem, it enables two-way IP interactivity over satellite. **www.newtec.eu**

MARKET WATCH

The **WORK Microwave** high speed satellite DVB-S/S2 Modulator, with optional multi-stream input (up to 8), wide V-Band (50-180MHz) and / or L-Band output (950-2150MHz) has been developed for fixed satellite ground stations as well as SNG vehicles, fly-aways or any other mobile or portable applications. It supports DVB-S2 transmissions in VCM and ACM to ensure the highest transmission throughput at all times. An optional multichannel BISS encryption module is available. **www.work-microwave.de**

WORK Microwave DVB-S/S2 Modulator

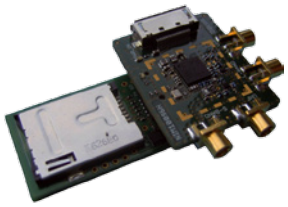
Televes has just launched the T.0X head-end, which is designed for the distribution of all of today's modulation standards. Particular attention has been paid to power consumption efficiency. New functionalities have been incorporated to ease the task of configuring and customising head-ends for SMATV installer. The new NEURON management software enables the remote configuration and control of the T.0X in a user-friendly interface accessed via any type of LAN or WAN IP network. **www.televes.com**



Televes T.0X Head-End

Sony has introduced its BRAVIA 2010 line that features built-in tuners for easy access to subscription free digital TV channels on Britain's Freeview terrestrial platform. The built-in Freeview HD tuner enables the reception of DVB-T2 transmissions without the need for a set-top box. The new product line-up also features intelligent sensors and eco-features to help make life easier and greener, and save on household bills. **www.sony.com**

Sony BRAVIA 2010 DVB-T2 IDTV



DiBcom DIB10096 Circuit

DiBcom has introduced a new circuit based on its Octopus platform, the DIB10096 providing DVB-T, DVB-H, and DVB-SH reception amongst other non-DVB standards. Besides its TV standard programmable feature, it also includes a DVB descrambler allowing it to receive CAS protected content. The Conditional Access smart-card is connected to the DIB10096 by a standard ISO interface, removing the need for Common Interface. Its enables pay-TV in handsets like PND, PMP or tablet, embedding a standard multimedia processor. **www.dibcom.com**

Verimatrix has extended its pay-TV security platform, the Video Content Authority System (VCAS), with two new products: Adaptive Content Security Manager (ACSM) and ViewRight Web. These software-based components manage authentication, key distribution and user control for pay-TV operators implementing HTTP adaptive rate streaming over managed and over-the-top IP networks, without smart cards. VCAS provides a single content authority for multi-network, multi-screen operators, leveraging DVB, Hybrid, IPTV, Internet TV and mobile devices including iPhone and Android. **www.verimatrix.com**

The **iDirect** Evolution X5 is a powerful, next-generation satellite router that enables service providers to support higher data rates and greater traffic volumes to meet increased customer demand. With optional features such as integrated spread spectrum waveform technology and AES 256-bit encryption, it's a flexible router capable of supporting a wide range of vertical markets including enterprise connectivity and cellular backhaul, and mobile applications such as maritime. **www.idirect.net**

iDirect Evolution X5 Router

Ocean Blue Software has enhanced its mature and proven DVB and DSM-CC software stacks to be compliant with the new HbbTV specification. The specification stipulates the need for a DVB and DSM-CC stack; the company has incorporated the HbbTV extensions and can now offer browser companies and CE vendors requiring those components of the HbbTV framework a compatible solution. **www.oceanbluesoftware.com**

The new **Panasonic** TX-P42G20B plasma TV features both a DVB-S tuner for Freesat HD and a DVB-T2 tuner for Freeview HD. It boasts a host of features to deliver moving picture resolution and colour reproduction together with networking features, brilliant sound and easy operation, for optimum HD viewing experience. **www.panasonic.co.uk**

Panasonic TX-P42G20B Plasma TV

Imagination Technologies has announced the latest member of its video decode IP core family. POWERVR VXD391, available for licensing now, is a low power, high performance, multistandard and multi-stream high definition, hardware video decoder IP core that now supports the full range of standards vital for internet video including Real Video 8 & 9/10, On2 VP6, and Sorenson Spark. **www.imgtec.com**

Advantech Wireless has launched its Transcend 800 product range of high-capacity, point-to-point, ACM-enabled microwave radios. The new model features native DVB-ASI I/O to enable broadcasters to connect transport stream sources directly without the need for expensive transition equipment or encapsulators. Delivering up to 800Mbps, multiplexed from a variety of data interfaces, including DVB-ASI, the unit also incorporates a powerful Layer 2 Gigabit Ethernet Switch and Layer 3 Gigabit Router for IP traffic. **www.AdvantechWireless.com**

Advantech Wireless Transcend 800

Designed to receive and record Freeview HD services, the new **Sharp** TU-T2HR32 features a 320GB hard disk drive and dual DVB-T2 tuners, allowing users to watch one channel whilst recording another. With a user-friendly interface, the box supports HD up to 1080p and standard definition broadcast upscaling (1080p/50) and has HDMI output, Dolby Digital Plus, and an ethernet port for interactive and future internet-based services. **www.sharp.co.uk**

Sharp TU-T2HR32 DVB-T2 Twin Tuner PVR

Our Most Powerful Modulator Yet !!!

- GbE-TStream Input based on Pro-MPEG CoP #3
- Adaptive Linear and Non-linear Pre-correction
- Available in both enclosed and board version
- WEB GUI, SNMP, Telnet Remotly Upgradable
- Improved MER and Shoulder Performance
- RF output from 50MHz to 1.5GHz
- SFN and MFN support

Software Selectable support for the following International Broacasting Standards:

- **ISDB-T / TB** (ARB STB-B31 and TR-B14)
- DVB-T / H / SH (ETSI DVB)
- ATSC (A/53, A/54, A/64 and SMPTE-310M)
- DAB, DAB+ and T-DMB (ETSI DAB and EU147)
- CMMB (GY/T 220.1-2006 and 220.2-2006)
- DTMB (GB20600-2006 and GY/T 229.1-2008)

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