DVBSCENE

THE REVOLUTION WILL BE TELEVISED

starring

UHDTV and HEVC

A Stakeholders' Parable
A Word From DVB

One of my personal highlights in 2013 was the successful approval and publication of the new CI Plus 1.4 specification. The specification was approved in September after very intensive and controversial discussions. The most critical issue was a feature called "application priority". Behind this term stands the question of who has priority for screen access: interactive applications being initiated by the CI Plus module or the services within the broadcast stream.

Traditionally, broadcasters had 100% control over the services and the viewing experience for the end-user. Today's Smart TV providers and Network Operators offering interactive services or applications also want to have access to the screen. Consequently, it was no surprise that the issue of "application priority" came up in the CI Plus meetings and resulted in intensive debates. However, in the end a compromise was arrived at, which served the interests of the broadcasters and other parties. This for me is the critical point. In DVB, we have a proven 20 year track record of bringing together the stakeholders of the broadcast industry to discuss, debate and finally agree on new specifications. This is why the broadcast industry values DVB as a platform to solve issues surrounding new technologies.

Of course this only works when the relevant stakeholder groups are well represented in the DVB membership and participate in DVB activities. My concern now is that broadcasters are more inclined to think they should focus on the creation of content and leave technology to manufacturers and network operators. However, as the

Peter Siebert
Executive Director

example of the new CI Plus specification clearly demonstrates, this approach could be detrimental to the interest of the broadcasters. I would like to encourage broadcasters to continue their active participation in DVB. The key to our success in providing the best possible standards for the broadcast end-user is the active participation of all the stakeholders.

New Standards

TS 102 809: Signaling and carriage of interactive applications and services in hybrid broadcast/broadband environments (Jul - 2013)
TS 101 162: Allocation of identifiers and codes for Digital Video Broadcasting (DVB) systems (Nov - 2013)
TS 101 211: Guidelines on implementation and usage of Service Information (SI) (Dec - 2013)
TS 102 825-4: Content Protection and Copy Management (DVB-CPCM); Part 4: CPCM System Specification (Dec - 2013)
TS 102 823: Specification for the carriage of synchronized auxiliary data in DVB transport streams (Jan - 2014)

New Members

Creonic GmbH provides IP (Intellectual Property) cores as ready-for-use solutions for several algorithms of communications such as forward error correction (LDPC and Turbo coding), synchronization, MIMO, and OFDM. The product portfolio covers standards like DVB-S2, DVB-C2, DVB-RCS, DVB-RCS2, WiFi, UWB, and GMR. **www.creonic.com**

Digital TV Labs Ltd is an independent and specialist digital media testing company, with testing and development facilities in the UK and Hong Kong. Originally focused on broadcast DVB receivers, it additionally provides a range of global, professional services focused on digital media devices to operators, broadcasters, regulators and trade bodies. **www.digitaltv-labs.com**

LinQuest Corporation has a 35 year heritage in providing satellite communications systems engineering, analysis, simulation, development, and operations services. **www.linquest.com**

SPINNER GmbH develops and manufactures high performance components for RF technology. It provides innovative products and customized solutions for its customer base. **www.spinner-group.com**

Teledyne Paradise Datacom is a leading supplier of satellite communication equipment to users around the world. It designs and manufactures satellite modem and RF equipment (including transceivers, block-up converters, solid state power amplifiers, frequency converters and TWTA amplifiers). **www.teledyne.com**

Village Island Co., Ltd is an established team of engineers, dedicated in delivering solutions to the broadcast industry. It strives to identify customer needs and respond through the use of top quality products from leading manufacturers. **www.village-island.com**

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In My Opinion

Is the Broadcast Industry still relevant?

Joshua Stinehour, Managing Director, Silverwood Partners

Joshua Stinehour is a member of Silverwood's Technology, Media and Telecommunications group focused on the media technology sector. He is a recognized industry expert in media technology strategy and is a frequent presenter at conferences and trade shows. He has executed a range of transactions including mergers and acquisitions, valuations, and private placements. Prior to Silverwood, he worked in various positions at EMC Corporation.

The goal of this article is to capture the most relevant media trends for vendors and investors in the Broadcast Technology Industry. It may surprise the reader, but there are a large number of technology vendors in the sector backed by institutional investors. Perhaps further surprising is the interest from the financial community in making additional investments in the industry.

It should not be forgotten that the vendor community supports a large and lucrative professional video industry – ranging from studios and broadcasters, to pay TV operators. Fundamental to an optimistic view for the vendor community is a favorable expectation of customer performance. The observation that media organizations are lucrative businesses is self-evident. Traditional television is still the dominant medium for advertisers, the preferred medium for reaching voters in political elections, and the leading medium for distributing live events (particularly sports). Adding to the position of television in developed countries, growth in television revenues within emerging markets is a safe assumption, as no data point exists countering the observation that as individuals become wealthier they watch more television.

There is every expectation that incumbent media organizations will remain lucrative businesses for the foreseeable future. Most (all?) examples of "disruptive" new media either pay traditional media a significant amount of money for content (Netflix), generate substantial operating losses (LOVEFiLM), or some combination of the two (Hulu). It is challenging to "make it up on volume" if gross margins are slim and operating leverage is difficult to attain, as new media typically has variable content delivery costs that do not burden traditional media distribution.

While less data is available on the state of media customer budgets, the available information suggests relative stability. Moreover, regardless of directional movements in budgets, there persists an unavoidable need for technology to run a media organization. The recent studio construction project by Fox Sports 1 in the United States (to support its August 2013 launch) is a timely example of the strategic importance of technology to media organizations.

Other evidence for the persistence of media customer technology budgets is found in the cautionary situations where media organizations have attempted to develop and build core video technology internally. The BBC Digital Media Initiative is a recent, prime example where, after spending roughly five years and £100 million, the undertaking "… generated little or no assets" (Anthony Fry, BBC trustee). The BBC ultimately learned a costly lesson that many others have learned – the technology for producing and distributing professional video is actually quite difficult. Also learning this lesson from time-to-time are broader technology companies. At regular intervals it is fashionable to expect broader technology companies to subsume the specialized vendors in the industry. It has yet to happen and is unlikely to happen in the near term. Such technology companies are focused on selling broadly applicable solutions across multiple verticals. The level of specialization necessary in the broadcast sector does not lend itself to such an approach.

There is cause for optimism among broadcast technology vendors in excess of the comfort of customer stability. Multi-platform distribution and related technologies are real. How people view content is unquestionably changing; however, how media companies monetize content is not. For all of ESPN's investments and focus on new forms of reaching customers, the organization still makes all of its money the old fashioned way – television subscribers and television advertising.

There will be a day when multi-platform is economical for media organizations and technology will play a key enabling role. Until that time, technology will play an equally critical role in softening the current dreadful economics of new mediums. Becoming more efficient through streamlining workflows and business processes is the foremost business priority for media companies. Recent IABM end-user surveys offer confirmation, as efficiency is now cited as having the greatest influence in the buying decision after the principal criteria of price and specification. The immediate implication of a focus on efficiency is a desire by media organizations to continue to prosper in a dynamic, unknowable future environment. This suggests customers require the specialized knowledge and capabilities of broadcast technology vendors more than ever.

The Multi-Platform Example

ESPN — September 2013 Digital Media Results
(Source: Company Press Release)

72.7M Unique Vistors	326M Digital Video Clips	650M Minutes	15M Tweets

"Despite the obvious fact that the way content is delivered and consumed has changed forever, this has not yet translated into profitable revenue streams for end-users." - Big Broadcast Survey, 2013

How ESPN makes money...

TV Ads	TV Subscription	Print Ads $0.2B	All Digital Ads $0.7B
$3.5B	$6.5B		Online Video Ads
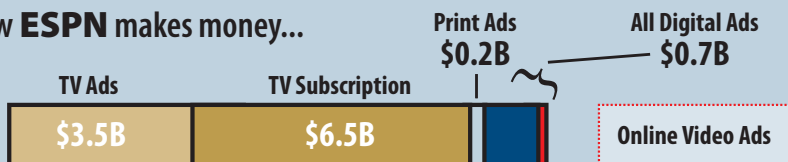
Source: Wunderrlich Securities, Company Guidance

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A Ray of Lite

Putting GSE to work in a consumer environment

Alexander Adolf, Chair TM-GBS

The DVB Generic Stream Encapsulation protocol (DVB-GSE, TS 102 606) allows for the efficient encapsulation of IP and other network layer packets over the second generation DVB physical layer specifications DVB-S2, DVB-C2, DVB-T2, and DVB-NGH. The first generation of DVB standards only supported data transport using the MPEG format with a Transport Stream packet multiplex (MPEG-TS). DVB-GSE maximizes the efficiency of IP datagrams transport, reducing overhead by a factor of 2 to 3 with respect to DVB-MPE over MPEG-TS. Performance simulations for DVB-S2 showed that for typical HTTP traffic, DVB-GSE introduces an overhead of about 2.3%, which is on par with the 2.1% of the MPEG-TS. This is achieved without any compromise of the functionalities provided by the protocol, due to the variable length Layer 2 packet size, suited to IP traffic characteristics.

When I presented the first version of the DVB-GSE specification to the Technical Module back in 2007, DVB-S2 had only just been published and DVB-GSE had been conceived and developed in response to needs of the professional satellite services community. These services were aimed at IP trunking applications, using DVB-RCS as the backhaul. In this environment, the receivers and modems were built to order, memory and processing requirements were second to speed and versatility, and the configuration was provisioned in the receivers before installation. Those services are still operated and offered today; of course using DVB-RCS2 as the backhaul.

Now, six years later, IP traffic has gained a lot of momentum. TV sets are "smart", or "hybrid"; meaning they make use of an Ethernet or WiFi connection, incorporate web browsers, and are capable of displaying progressive download and streaming content. Hence the idea of applying DVB-GSE in the consumer domain became tangible. However, due to the high versatility designed into DVB-GSE for its use in professional applications, mainly the memory, the processing requirements turned out to be prohibitive. In a professional GSE receiver, the memory footprint of the GSE protocol implementation is typically on the order of 16 Mbyte. This is in the order of two full-HD frame-buffers, and hence totally out of the question for any consumer receiver implementation. To be suitable for consumer devices, the memory requirements should be in Kilobytes rather than Megabytes.

To reduce the memory and processing requirements at both the transmitter and the receiver, the GSE-Lite profile has therefore been conceived to provide a simple yet completely functional sub-set of DVB-GSE. The GSE-Lite profile has been designed with IP traffic in mind, but it retains many of the generic features of the full GSE profile. GSE-Lite is equally targeted at, and suitable for all second generation DVB physical layer specifications DVB-S2, DVB-C2, DVB-T2, and DVB-NGH.

As shown in the diagram, the GSE-Lite profile defines restrictions on five parameters of the GSE protocol. The cap on the PDU and GSE packet sizes, together with the two fragmentation restrictions, leads to a reduction of the memory footprint to some 7.2 Kbyte. This is perfectly within the limits of what is
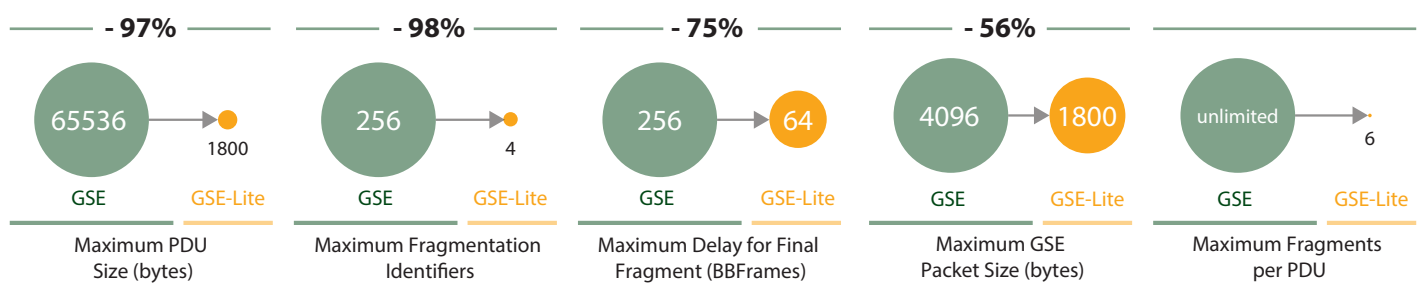
Alexander Adolf works as an independent consultant in digital broadcast technology through his company Condition-ALPHA. As chair of the TM-GBS working group, he was the editor of the DVB-GSE suite of specifications. Currently, he is the representative to DVB and HbbTV for LG Electronics. He is a member of the Association of Engineers in Germany (VDI).

affordable for a consumer receiver. Finally, the limit on the number of fragments per PDU limits the time until a receiver can reassemble an entire IP datagram, and therefore the latency of download sessions. This in turn allows service providers to rely on a minimum quality, depending on the link data rate. DVB-GSE-Lite makes direct carriage of IP traffic on DVB broadcast bearers to consumer receivers commercially viable.

The use of standard GSE, or the GSE-Lite profile is signaled in the header of the baseband frames of DVB-S2, DVB-C2, DVB-T2, and DVB-NGH. Some header bits, which are unused in generic stream mode, are allocated to signal the use of GSE-Lite. As a result, GSE-Lite streams are backwards compatible, and can be received and processed by all existing GSE receivers.

The latest version of the GSE specification, containing the definition of the GSE-Lite profile, is available as DVB BlueBook A116-1 from the DVB Website. It will soon become available from ETSI as TS 102 606-1.

GSE vs. GSE-Lite profile comparison

- 97%	- 98%	- 75%	- 56%	
65536 → 1800	256 → 4	256 → 64	4096 → 1800	unlimited → 6
GSE → GSE-Lite	GSE → GSE-Lite	GSE → GSE-Lite	GSE → GSE-Lite	GSE → GSE-Lite
Maximum PDU Size (bytes)	Maximum Fragmentation Identifiers	Maximum Delay for Final Fragment (BBFrames)	Maximum GSE Packet Size (bytes)	Maximum Fragments per PDU

Evolutionary Steps

CI Plus - today and tomorrow

Paul Szucs, Senior Manager, Technology Standards, Sony

Paul Szucs has been with Sony since 1993 as an R&D engineer, technology standards developer and business development and industry alliances manager, at Sony's Stuttgart Technology Centre, Germany. He was chair of the DVB Technical Module AHG CI-Plus and editor of the CI+ V1.4 specification.

The Common Interface (CI) and CI Plus have a long and winding history. The original CI specification, EN 50 221, was published in 1997. Extensions were specified within the DVB Project and published as TS 101 699, in 1999. The CI Plus LLP consortium then developed the CI Plus specification, up to V1.3, which mainly added the feature of secure return link to the Host. In 2011 the DVB and CI Plus LLP agreed that new developments of the CI Plus specification would be undertaken within the DVB once again.

The CI-Plus Ad Hoc Group of the DVB Technical Module was launched in November 2011 with the task of producing a "CI Plus Extensions" specification, also commonly referred to as CI Plus V1.4. It was to be an extension of the V1.3 specification, still maintained by CI Plus LLP as a publicly available industry specification. The Commercial Requirements called for a wide variety of new features in CI Plus V1.4: multi-stream support, carriage of IP delivered content, some CI Plus browser extensions, CICAM (Common Interface Conditional Access Module) application launching, URI (usage rules information) extensions, and a concession with watermarking and transcoding on the CICAM. In particular, the first two of these represented considerable technical challenges. Furthermore, the full complexity and commercial sensitivity around CICAM application launching emerged and had to be addressed. Oh, and by the way, the work was to be completed within 12 months! The diagram shows how the new functions of multi-stream handling and IP delivery extend the scope of CI Plus V1.3.

So far, only a single complete transport stream could be carried over CI and CI Plus. Multi-stream mode in CI Plus V1.4 allows multiple services from one or more different physical tuners in the Host, as well as the IP network interface, to be multiplexed dynamically on the transport stream interface to the CICAM. The conscious decision was taken to stay with the existing electrical characteristics of CI and CI Plus, and apply PID filtering in cases where the maximum bit rate (96 Mbps) of the transport stream interface would be exceeded.

"Connected" TVs are becoming ubiquitous, and so naturally the path has to be opened also for IP delivered content on the Host device to be delivered to CI Plus for decryption. Two modes of IP delivery are specified in V1.4. They both accommodate MPEG-2 TS and MPEG-4 file format container content:

- Host player mode, where the Host device is in control of the delivery over IP and requests the CICAM to decrypt the IP delivered stream that it passes through.
- CICAM player mode, where the CICAM is in control of the delivery over IP and provides a conventional CI Plus transport stream for the Host to receive.

As well as the existing CI Plus MHEG-5 based browser, V1.4 allows other systems' interactive applications to be launched by and/or from a CICAM, to run in the Host. While being a great new feature in CI Plus, it does make the landscape more complex, particularly the coordination of CICAM applications with applications of the same or different environments being provided in broadcast streams. In order to mitigate unpredictable CICAM and Host behavior, CI Plus V1.4 specifies a framework of rules whereby broadcast applications, if present, are given precedence over CICAM applications by default, but each individual user must be able to make the ultimate decision about which gets precedence in their Host device. Hence, Host manufacturers are required to include configuration options in their CI Plus V1.4 capable devices to enable the user to control this aspect of CICAM and broadcast application behavior.

The CI Plus Extensions specification was published as DVB BlueBook A165 in September 2013, and revised in October. As with most DVB specifications, CI Plus V1.4 has been submitted to ETSI for formal standardization. That drafting has been completed; CI Plus V1.4 will appear as ETSI TS 103 205 V1.1.1 soon after the writing of this article. Work on CI Plus in DVB will continue on two fronts – potential further extensions of V1.4, and on a new form factor for CI Plus, adopting the USB interface.

The commercial deployment of CI Plus has been managed so far by CI Plus LLP, who have set up the required Trust Authority and compliance regime for its use in the market. At the time of writing CI Plus V1.3 is just being rolled out. It might take another 12-18 months for the first commercial deployments of V1.4 to appear, but there is strong interest from the industry. CI Plus V1.4 promises the evolutionary steps of IPTV services "down-sizing" the STB, and providing another way to include CA/DRM-protected content in "over-the-top" and hybrid broadcast-broadband content offerings.
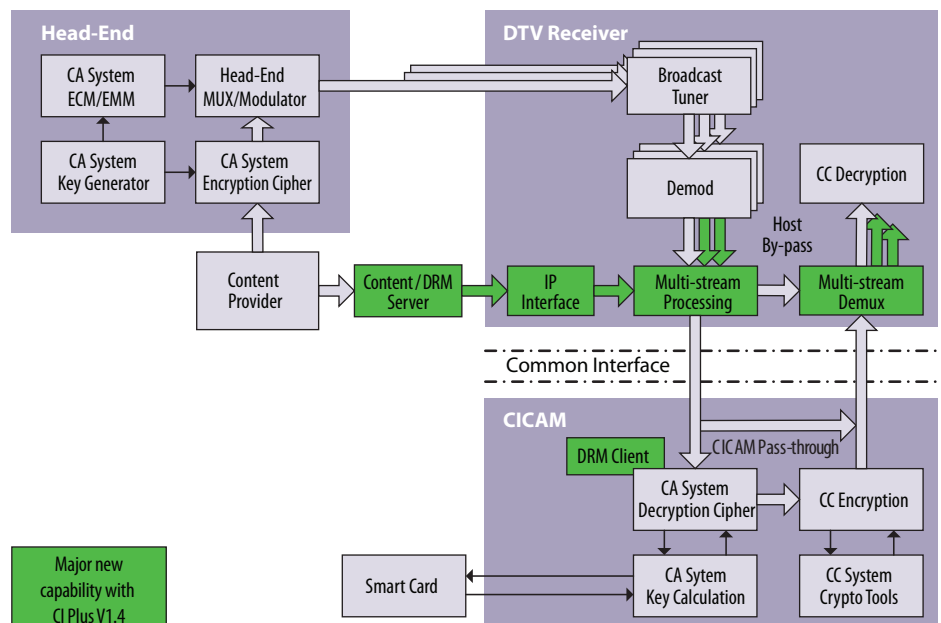
Teamwork

Demonstrating the strength of the DVB network

Feyo Kolff, Marketing & Communications Manager, DVB

Feyo Kolff

With DVB, EBU, SMPTE, ITU and many other organizations developing standards and roadmaps for 4k Ultra High Definition (UHD), 2013 was a big year for UHDTV. In September 2013, DVB demonstrated the transmission of HEVC encoded UHDTV signals over its three second-generation broadcast standards, DVB-T2, DVB-C2 and DVB-S2. These demos were very well received and not only showed the benefits of the new DVB technologies, but also showed the benefits of joint demos for DVB Member companies.

During the IFA exhibition in Berlin, the ANGA-DVB booth included three groundbreaking demonstrations of UHDTV delivered over DVB-S2 and DVB-C2. The DVB-S2 demo included a live HEVC encoded signal from Eutelsat's uplink station in Paris, which was demodulated and fed directly into Village Island's HEVC contribution decoder. A second demo showed UHD content encoded with H.264 and transmitted via DVB-S2 by Eutelsat from Paris and received on a TV with an integrated S2 receiver. A third demo included the first-ever UHD over DVB-C2 transmission using a local C2 modulator and demodulator. Other demo partners included Kabel Deutschland, Sky Deutschland, Broadcom, LG and Samsung.

For the IBC exhibition, DVB demo partner Arqiva organized a live DVB-T2 transmission in Amsterdam covering the entire trade show. This transmission combined an HEVC encoded UHD stream over DVB-T2 and a T2-Lite signal for mobile reception, showing the wide range of the capabilities of T2. This includes one of its advanced features called Multiple PLPs (Physical Layer Pipes), which allows for the separate adjustment of the robustness of each delivered service within a channel to meet the required reception conditions. The main UHD signal was received on a set-top box with Broadcom HEVC decoder and T2 demodulator chips and displayed on a Sony UHD TV and the mobile signal was received on a T2-Lite Sony dongle attached to a tablet computer. Other demo partners included BBC, SES and 3net Studios.

These various demos showed the flexibility, power and efficiency of the second-generation DVB broadcasting standards and showed that all three standards can comfortably carry UHDTV signals, which can easily reach 20–30 Mbit/s per stream. Secondly, these demos again showed the varied and strong combination of DVB's membership. Over the past twenty years, DVB has worked with a very long list of member and partner companies on joint demos that showed proofs of concept, interoperability, efficiency and the flexibility of DVB standards and related technologies, including 3DTV, UHD, CI Plus, emergency warning systems, mobile and of course delivery over the second-generation standards.

DVB has always been a market and member-driven organization. Once a standard has been completed and approved, it is essential to organize joint demos that show the power of standardization, interoperability and the strength of the DVB Member network. With DVB standards constantly being created and updated, and new TV and video technologies around the corner, there will be an ongoing need for more innovative joint demos. Please keep an eye on our events calendar and contact us if you would like to join future DVB demos at exhibitions, workshops, conferences and other events.

Live HEVC encoded UHD stream over DVB-T2 and mobile T2-Lite

Demo Partners

Rough Diamond
The nitty-gritty of UHDTV takes shape

David Wood, Chair CM-UHDTV

David Wood, EBU Consultant

Some things in life are certain: death, income tax, and more DVB meetings. Digital television continues to engage DVB in new technical challenges, one of which is Ultra High Definition Television (UHDTV).

There are two ITU UHDTV 'levels'; UHD-1 or Ultra-HD (the 8 Megapixel image level) and UHD-2 or Super Hi-Vision (the 32 Megapixel image level). DVB is currently developing potential broadcast formats for the lower level, UHD-1. We know of no plans yet to make UHD-2 consumer displays available.

Discussions in 2013 led us to believe that a number of 'Phases' of UHDTV were needed. Initial home decoders (MPEG HEVC) would not be able to cope with all the ITU UHD-1 parameter values. Decoder 'memory bandwidths' will evolve in steps. The first, in 2014/15, would be able to decode some of the UHD-1 specification - up to 60 images/second; and the next, in 2017/18, should be able to decode all of UHD-1 up to 120 images/second. There could be a third generation later, Phase 3, to decode UHD-2. Our hope is that each of these Phases will be compatible with the last, so that viewers who buy sets for earlier Phases will still be able to receive images as the services evolve.

The 'commercial requirements' for UHD-1 Phase 1 were prepared in Autumn 2013, with the hope the specification will be available in the first quarter of 2014. UHD-1 Phase 2 needs to be prepared next to give decoder manufacturers the lead time they need to develop decoders for commercial products.

Of course, DVB life is never simple. There are many complications. That's why we enjoy it. Phase 2 and 3 will be a challenge.

At the same time as DVB is developing broadcast formats, the broadband world is developing UHD-1 by internet. Apart from hybrid TV viewing, tablets are viewed close up, so the extra definition of UHDTV certainly has value. Traditionally, broadband video delivery cuts bit rates down to the bone to minimize network congestion, so we might not expect 'full UHD-1' via broadband. But if software decoders can handle the UHD-1 decoding,

this could be the quickest way to bring UHD-1 to the public's first generation UHD-1 sets, even if not 'pristine' UHD-1. But for broadband there is, for better or worse, much interest in using another compression form, VP9, rather than MPEG HEVC.

For broadcasting UHDTV, realizing the 'compatibility' with earlier Phases is not a piece of cake. We need to think about a whole range of parameter values for Phases 2 and 3. The actual screen resolution is only one of them.

Future Phase 2 broadcast, particularly sports, would benefit from high frame rates (100 or 120 images/second), double those used today - but we need Phase 1 sets (working at 50 or 60) to still have a decent image when they do. So, maybe Phase 2 needs to be a 50 or 60 signal with a 'top up' to 100 or 120 for those who can use it.

> ...any receiver from a tablet or smartphone to the largest UHDTV displays.

Yet another issue is 'colorimetry'. Phase 1 UHD TV sets in the shops now use primary colors (the color elements on the screen) termed 'Rec. BT 709', which have served us well for HDTV, but limit how 'saturated' colors can be in a TV image. To allow for a future world of 'better' primary colors, where more saturated colors are

possible, the ITU defined for UHDTV a wider set of primary colors (Rec. BT 2020). If we want to allow these wider primaries to be used in Phase 2, we have to work out what happens to first generation sets when they are used.

One more issue is 'dynamic range' – the ratio between the darkest and brightest elements in the image. The dynamic range we see in real life can be tens of thousands on a bright sunny day. Phase 2 should take into account how 'bright' TV screens will be in future; and, from this, use the dynamic range to provide the best viewing experience. This may call for new parameter values such as 'bit depth' and 'transfer characteristic', but arranged so that good images can still be seen on Phase 1 sets.

Nor should we forget the way UHDTV sound will be broadcast, and the value for very large screens of going beyond today's 'surround sound' with its 5.1 channels. The ITU has devised an imaginative way of being able to provide a flexible sound system for any receiver from a tablet or smartphone to the largest UHDTV displays. This aspect will also need to be considered in Phase 2.

2014 will see hard and difficult UHDTV discussion. But "no pressure – no diamond".

Shaking It Up
Switching to HEVC

Tom Morrod, Senior Director, Consumer Electronics, IHS

Tom Morrod, IHS

The video industry has a habit of being shaken up every few years by a new technology impacting some part of the supply chain. Recently, the roll-out of connected video devices such as smartphones, smart TVs, tablets and games consoles have done this, fuelled by video consumption over the open internet. At the other end of the spectrum, large screens have increased resolution to Ultra HD (UHD), four times that of Full HD, and OLED flexible screens will soon be enabling new form factors and possible disruptive device convergence or fragmentation. But arguably there is one technology that is really tying all of these changes together, and that is HEVC, the next generation video compression format allowing for more efficient transmission. The reason HEVC is so important is as an enabler for two simultaneous trends, online video delivery and high-resolution video delivery. Both will be defining elements of content distribution and consumption over the next few years, and both will influence each other too.
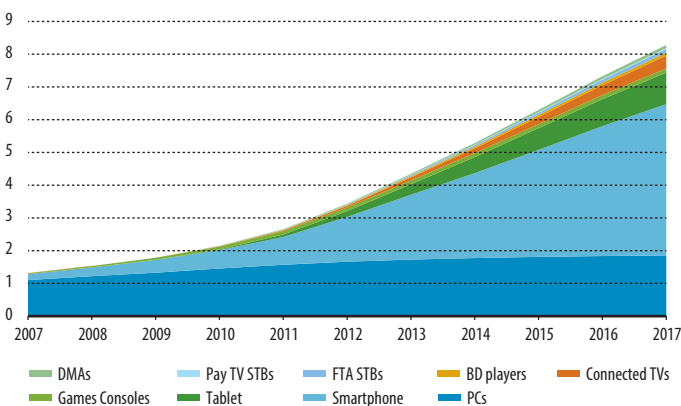
Switching the market from an MPEG-2 and MPEG-4 world to an HEVC world is more meaningful than it might at first seem. MPEG-2 and MPEG-4 have respectively enabled digital broadcast video and online video to consumer devices like tablets and PCs. This is the world of set-tops and TVs versus the world of Netflix and YouTube. Without these technologies, neither of these worlds would have developed - the ecosystems and the delivery technology would simply have

been too expensive to implement or too clumsy to be commercial. The current video industry, both online and traditional, would look very different.
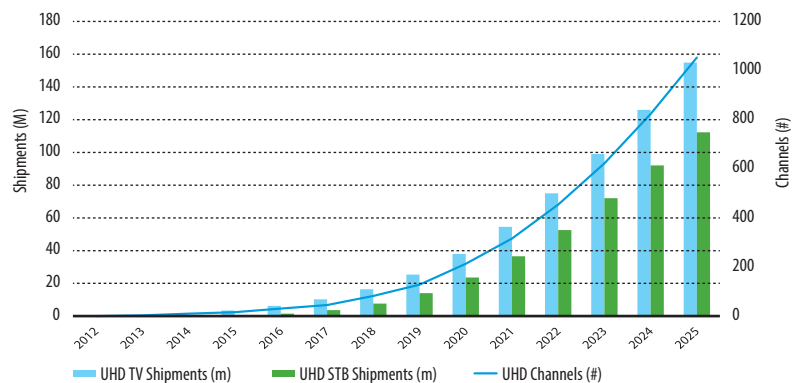
However, as time has passed the technology of video delivery has started to push at boundaries of consumer usage and need. For the well established pay TV industry, digital broadcast and living room TVs, high definition TV has become mainstream, and has lost its premium edge and pricing. This industry needs a new premium tier, but in a way that doesn't break the bank or create an economically unviable white elephant, much like 3G spectrum licenses have been for many mobile operators. UHD is one significant premium upgrade that could revitalise the TV hardware industry, requiring new consumer TVs, set-top boxes, content creation tools, storage technology, and transmission infrastructure - while also creating a new premium tier of content to support these costs. However, UHD, and the wider package of upgrades to video quality, all other things equal, will take up around four times as much transmission bandwidth as HD video. This is where HEVC comes in. HEVC is able to reduce the bandwidth needs for UHD to something closer to the cost of launching HD video over 10 years ago. UHD is back on the commercially viable side of the equation, and the ecosystem to support UHD – new TVs, set-top boxes, various professional technology – are all allowed to develop from the additional revenue streams afforded by consumers to upgrade their TVs and content packages.

This is just one side of the industry though. In parallel, a more disruptive trend has been the disassociation of premium content from the TV set and broadcast delivery, the development of video capable IP devices. The delivery of video over the internet has been made possible as broadband speed has increased around the world, and the proliferation of devices that can connect to the internet has driven consumer interest and need. From smartphones and tablets to smart TVs and games consoles, video over the internet, over the top of someone else's network, has shifted the cost dynamics and consumer use-cases for video. Consumption trends have subtly but meaningfully changed. Device ownership has skyrocketed. Disruptive content distributors have entered the market and redefined the business model of traditional broadcast and pay TV content bundling. One result has been to push towards higher quality content such as UHD, forcing the battle on quality and playing against the strengths of unmanaged networks and IP transport. The other result has been to meet consumer demand for access over quality, and device options over closed ecosystems. This has applied equally to traditional players, like broadcasters and pay TV, as it has to new entrants like over-the-top video platforms and the range of non-video companies like publishers, retailers and consumer brands

Global installed base of connected devices (bn)

Legend: DMAs · Pay TV STBs · FTA STBs · BD players · Connected TVs · Games Consoles · Tablet · Smartphone · PCs

UHD Uptake: 2012-2025

Legend: UHD TV Shipments (m) · UHD STB Shipments (m) · UHD Channels (#)

that are looking to video to reach their consumers.

But the limitations of video over IP, and particularly when that premium video is not accounting for or contributing to network costs, is that the network rapidly falls behind on investment against demand – OTT content provision is cheaper than pay TV packages precisely because it doesn't pay for the network costs. This puts a limit on the number of people that can use online video delivery or the quality of content that can be transmitted. The main problem underlying this is that unicast IP delivery is limited in bandwidth when used by many people at the same time, and the networks transmitting IP video will not be able to handle the traffic currently managed over broadcast delivery.

But unicast IP is important for tailoring content consumption options and vital for access on unmanaged devices, especially

out of the home. These are consumer trends that will not be reversed. Once again, technology enablement shifts the limitations to this industry. HEVC allows more content in better quality to more people under the same network constraints. Much like MPEG-4 and MPEG-2, it can support device decoding in software with relatively low cost processors due to the structure of the codec. HEVC is likely to provide less need for adaptive streaming, fewer cases for buffering, allow for higher concurrency at the same image quality, and allow for more frames, colors or resolution at the same bandwidth.

From a market point of view, HEVC couldn't be timelier. The limitation for content differentiation over broadcast networks has been eroded by higher quality content streaming online. But the limitations of online content delivery are getting dangerously close to causing

meaningful problems with the core and edge network capacity, which would cap the video quality and consumer interest. HEVC is unique in being the only unifying technology that spans the two very contrary trends emerging in this world – higher quality video in the form of UHD, and better online video streaming to unmanaged devices. Within the next few years, the UHD ecosystem for TV will become established and transmission, content packaging and revenue will start to feed back to higher quality content production. Around the same time, in 2017, we'll pass the milestone of one internet connected video device per person in the world – actual devices able to stream video from the internet. These trends are both hugely important for the future of video and the definition of TV. And they will both be truly enabled by a new compression technology, HEVC.

Tom Morrod heads up research on professional video and media managed services and is responsible for all research across tablets, TV sets, set-top boxes, home audio, wearable technology and consumer peripherals, as well as research into connected devices and the use of consumer electronics for video and media consumption. In addition, he manages all research into digital signage, professional media technology, distribution and services including pay TV networks, broadcast equipment, media managed services and media technology intellectual property.

Moore Analysis

The Ultra HD Splash at CES

Myra Moore is the chief analyst of DTC, a boutique market research firm that analyzes the worldwide consumer digital TV market and aids countries in transitions to first and next generation DTT.

For more information, please see: **http://dtcreports.com/dtv.aspx**

Bigger and better gets the most attention at the Consumer Electronics Show and 4k TVs commanded that spotlight during the annual consumer tech fest. Although the UHD TVs shared the main stage with wearable electronics, action camcorders and other gadgets, there is no piece of hardware more important to broadcasters (for all platforms) than the big screen display.

The big name worldwide TV suppliers, as well as up and coming domestic Chinese brands working to break into new markets, now have these TVs in stores. From development to commercial availability (including the race to slash prices), this latest iteration of high definition came on fast.

What impact, if any, will this latest TV evolution have on broadcasters? For traditional broadcasters it plays to the industry's strength of delivering beautiful and immersive pictures to viewers. Whether

or not the increase to 4k resolution is sufficient enough to encourage recession weary tightfisted consumers to buy new sets remains to be seen.

What it does do, however, is reinforce the urgent need for the broadcast community to innovate. It's hard to believe that it has been more than 15 years since the broadcast industry (DTH satellite and terrestrial) began the digital TV revolution, but it has. Adopting next generation compression technology (HEVC) to create higher definition pictures is an important improvement but there are other roles HEVC can play that are equally as important, such as gaining virtual bandwidth with its greater coding efficiencies. Other innovation, however, is needed to catch up to the IP (internet protocol, not intellectual property) TV revolution that has been just as profound as

the digital one swept in by broadcasters in the last century. And those engineers and other industry leaders developing next generation standards for digital terrestrial TV understand that they must harmonize with this delivery method (and others) to stay relevant.

The harmonization can be as simple as promoting the pairing of media streaming with next generation digital terrestrial receivers to appeal to the "cord cutting" set. Or, it can be as radical as a more technically advanced hybrid system that would blend LTE and digital terrestrial transmissions to create a system than ensures simultaneous reception of unicast and broadcast services. The DVB's former technical chairman, Ulrich Reimers, and his university team created intense interest at last year's IBC when demonstrating the method dubbed "tower overlay." Stay tuned.

Broadcasters could meet the traditional big screen UHD TV challenge by incorporating HEVC encoders into existing infrastructure, but the betting is that broadcasters will need to do more than simply deliver higher resolution pictures to keep up with the profound changes in the business of delivering programming.

Turkish Insight
Moving to digital with T2

Taha Yücel, Member of Supreme Council, RTÜK

Taha Yücel was elected in 2005 to the Radio and Television Supreme Council (RTUK) by the Turkish Parliament. Prior to that, he worked in the Frequency Planning and Allocation Commissions, and in the Commission of the Preparation of Radio and Television Standards. He also worked at TGRT, a private national broadcasting company as the Deputy General Director and was Chairman of the Technical Commission of the Association of Television Broadcasters.

The Turkish broadcasting regulator, RTÜK (Radio and Television Supreme Council), was set-up in 1994 and is composed of nine board members elected by the Turkish Parliament. It regulates both the technical and content aspects for all radio and television broadcasters in the country. The main responsibilities of the Council include frequency planning and allocation, licensing and content monitoring.

With the convergence of the broadcasting, information and telecommunication sectors, the need arose for further broadcasting regulations. On 3 March 2011, the Parliament approved a new legislative framework for the broadcast industry, which resolved a number of issues and established an agenda for the launch of DTT services. It also required that the RTÜK organize the tender for DTT licenses by March 2013, with licenses to be available for a ten year period (compared with the previous five year period) and broadcasters obliged to launch their DTT services within two years of the license allocation. It also set aside the 800 MHz band for mobile telecom services although the timeline for its availability has not been set.

The broadcasting sector in Turkey is developing rapidly. The Turkish Statistical Institute reports that there are nearly 19 million TV households and 1,323 broadcasting companies, mostly radio broadcasters, overseen by RTÜK. Satellite penetration is very high with 247 licensed satellite television channels and two pay TV cable platforms, one of which is IPTV and the other standard cable TV with nearly 4.8 million subscribers. Total advertising revenue generated by the broadcasting sector indicated that it is growing in proportion to the Turkish economy.

As in the rest of the world, radio frequency spectrum is a scarce resource that has to be used efficiently. The plans for the transition from analog to digital, defined at the ITU Regional Radiocommunication Conference in 2006 (RRC-06), divided Turkey into 96 allotment areas. In accordance with the agreement (GE-06), reached at RRC-06, the RTÜK was tasked with preparing a digital migration and frequency plan to cover the country's 800,000 square kilometers (more than three times larger than the UK and more than twice as large as Germany), most of which is comprised of mountainous terrain.

These preparations included the adoption of DVB-T2 and MPEG-4 compression technology to offer both standard definition (SD) and high definition services (HD). Receiver standards for DTT services have been agreed and published by the Turkish Standards Institute to allow a quick and trouble-free implementation of DTV. This is backed up by a Test and Approval Center that will be set up with responsibility for all aspects of receivers and test procedures. As DVB is currently working on the inclusion of HEVC in DVB-T2, the RTÜK is also considering HEVC to be included in the receiver standard.

Digital terrestrial frequency planning was conducted over the last two years and as a result five multiplexes are planned for national broadcasters. One multiplex in each city is planned for local and regional broadcasters and one multiplex is planned for TRT, the public broadcaster. All SD channels will be 16:9 widescreen and there will be at least 11 HD national channels. DVB-T2 trials have been taking place in Ankara with three SFN transmitters since the beginning of 2013. Test results are also very favorable for digital portable reception.

The DTT network will be installed and operated by ANTEN, a company which has already been set up and is owned by 16 commercial broadcasters. It will utilize 952 transmitters to provide coverage to 90% of the population. It is expected that the remaining 10% of the population will access services using satellite reception. According to the legislative framework, it is not possible for any broadcaster to hold more than a 10% stake in ANTEN. Currently, a legal case is underway to determine whether it is legal for the public service broadcaster TRT to participate in the ownership of ANTEN.

Analog switch off will be realized region by region with a simulcast period of six months and will be completed in March 2015 according to the regulation.
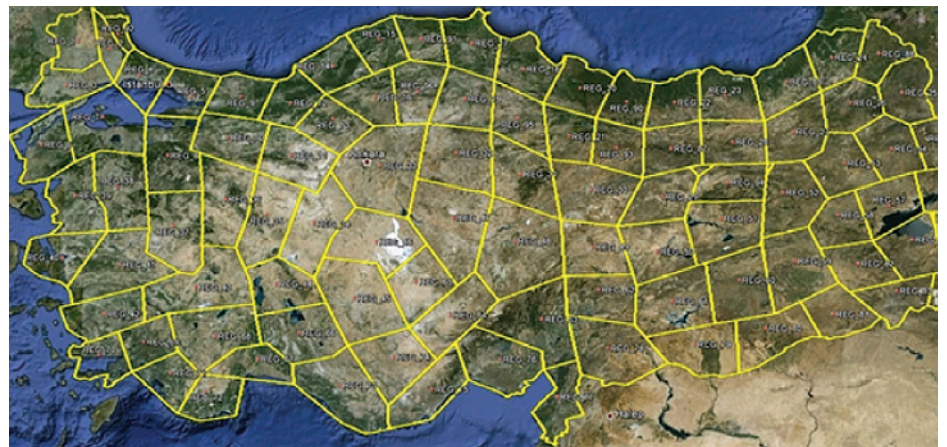
RRC 06 Allotment Areas

Taking Action Together

DTT, Spectrum & Other Issues

Simon Fell, Director of Technology & Innovation, EBU

DigiTAG, for those who are not familiar with it already, is the Digital Terrestrial Television Action Group and is the forum 'where all the issues related to the digital terrestrial TV market are discussed'. It is an association of stakeholders in the digital terrestrial TV industry and its members are broadcasters, network operators, regulators, and professional equipment and consumer electronics manufacturing organizations throughout the world. DigiTAG has relaunched in 2013 with new statutes which include all digital terrestrial TV standards, continuing in its mission of defending and promoting digital terrestrial television. Also with the promotional focus now moving to new markets, DigiTAG's remit is worldwide. The association has also pledged to work tirelessly to protect spectrum for broadcasting, regardless of the technical standard used on the DTT platform.

I was pleased to be elected as president of DigiTAG in December 2013, together with the vice-presidents Alex Mestre Molins of Abertis Telecom, who was re-elected, and Stan Baaijens of Funke Digital TV, also newly elected. It's clear to me that the association has been very successful at working hand in hand with DVB Members and other organizations, associations and standards bodies - since it was established, helping to promote and market the benefits of digital terrestrial in new regions. However, we are now at a crossroads in Europe. Digital terrestrial TV has been rolled out in many regions and new hybrid platforms are being developed to bring the benefits of free-to-air broadcasting together with broadband delivery of catch-up and other content. At the same time some countries are still developing their plans for digital transmission – the recent very well attended workshop in Turkey is testament to the power DigiTAG has to bring together industry expertise from its members to help move the debate on in these emerging markets.

We have four strands of activity:
• DTT Promotion - create momentum and raise awareness through exhibitions, workshops, the website and newsletters
• DTT Spectrum and Network Planning - in association with other organizations, to align, cooperate and coordinate spectrum activities and to show the real value delivered through digital terrestrial broadcasting
• DTT Market Development - to inform industry and policy makers about market developments and set up activities to help develop new markets and to assist in digital transition
• DTT Product and Service Development - to support harmonization by providing market information and guidelines and to help enable the evolution of digital terrestrial services, sharing best practices

We do all of this by meeting regularly to coordinate views. Our working groups are actively seeking to make a difference through supporting the ongoing lobbying for sufficient broadcast spectrum to allow DTT to develop. DigiTAG workshops in new DTT territories help them learn the lessons from other countries for the best way to develop interoperability between products and how to get the best from the standards that exist. Our unique ability to attract a diverse range of professional operators and manufacturers to such events delivers real value to attendees and has proven a successful formula to help broaden the debate and introduce members to these markets.

One recent initiative that we have begun to look at is to combine the market data on digital terrestrial developments in different countries into one accessible and well managed dataset. We are collaborating with BNE (Broadcast Networks Europe), the EBU's Media Intelligence Service and the DVB Project, and of course looking at DigiTAG's own data, to evaluate the potential for this.

Broadcasters and technology companies involved in digital terrestrial markets do not do enough to promote the range and diversity of products in this market. Consumers all over Europe benefit every day from great services and products which are becoming ever more reliable and innovative. Products such as digital video recorders and Connected/Smart/Hybrid TVs combine broadband and television to enrich this ecosystem. In recent years developments such as DVB-T2 have allowed High Definition video channels to be delivered efficiently via terrestrial broadcasting, enhancing consumers' enjoyment of free-to-air television. These great services are often overlooked in the mania that surrounds tablets and portable devices where, interestingly, it is the content originally promoted on broadcast channels that proves most popular.

Today 250 million consumers across Europe enjoy the majority of their entertainment via terrestrially delivered broadcasts, with DTT used on the primary TV set in 45% of households. We should not overlook this success story brought about by the combined efforts of this industry. DigiTAG is the place where we can celebrate these developments and share the knowledge more widely as digital broadcasting rolls on.

Simon Fell is Director of Technology & Innovation for the EBU, a position he took up in September 2013. He has more than 35 years' experience in senior broadcasting technology roles, including at British broadcaster ITV, where he was Director of Future Technologies (2008-2009) and Controller of Emerging Technologies (2004-2006).

From 1991 to 2004 he worked for the UK's Carlton Television, the ITV franchise holder for the London region, where he held several executive roles linked to operations and emerging technologies.

Prior to joining the EBU, he was Chairman of the Technical Council at the Digital Television Group, the industry association for digital television in the UK. He also represented UK broadcasters on the EBU Technical Committee between 2006 and 2009.

DigiTAG

MARKET WATCH

www.adbglobal.com

ADB's Multi-Screen blends cloud and broadcast delivery and home network redistribution to securely deliver pay TV services to thin clients, iOS and Android mobile devices at home and on the move. It takes the DVB broadcasts and redistributes them in the home network when subscribers are at home, providing access to all live channels, DVR recordings, catch-up, VOD and other OTT services for tablets and smartphones. It reverts to cloud when the subscriber is outside the home.

www.rohde-schwarz.com

The new Rohde & Schwarz R&S DVMS-B55 for monitoring DVB-T2 signals, in accordance with the latest version of the standard, also supports L1-post scrambling and T2-Lite. The R&S DVMS is one of the most successful monitoring systems on the market, especially for DVB-T/DVB-T2 transmitters and networks. It measures just one height unit and can simultaneously monitor the RF and transport stream characteristics of up to four signals - ideal for use at sites with multiple transmitters.

www.syes.eu

Syes PPT Transmitters, with amplifier technology, offer 40% efficiency in energy consumption without degradation of signal quality and power, with lower thermal balance, lower sensitivity to load-produced harmonics, and tighter response control. Also new is GTW, a DVB-T2 gateway. It is suitable for stream confectioning, T2 MI adaptation, Multiple PLP, and regional content reinsertion. It complies with DVB-T2 version 1.3.1 and supports DVB-T2-Lite. It features ASI & IP data formats and has a built-in GPS receiver.

www.enensys.com

T2Edge DTH from ENENSYS is a local DVB-T2 adapter and a component of the OneBeam DVB-T2 solution that allows the same satellite transponder to be used for both DTH and DTT services. Running at the transmission site, it receives the DTH stream, selecting the services from the stream to generate a T2-MI stream for Single Frequency Networks broadcasting. It is designed to perform advanced PSI/SI processing to update PSI/SI information related to the filtered services.

www.verimatrix.com

The Verimatrix Video Content Authority System (VCAS) for DVB introduces ECM-based fingerprinting (FP) for set-top boxes, including a smart cardless option, enabling service bound control with higher precision compared to EMM-based FP. The FP output can be switched on/off per channel. Display duration and screen position can be defined. The carrier mechanism is generic and can transport 50 bytes of FP data plus 2x50 bytes to trigger other actions, display stored images or ads.

www.teamcast.com

TWISTER from TeamCast comes as a ready-to-use, 1RU modulator/exciter rack specifically designed to be integrated inside new or existing TV transmitters. It brings DVB-T2 usage flexibility, supporting MFN System A, SFN System B, SISO/MISO, Multiple PLP layered and hybrid DVB-T2 and T2-Lite modulation. It incorporates the company's state-of-the-art Digital Adaptive Pre-correction (GAP - Green Adaptive Processing), Automatic Gain Control and offers full monitoring of transmission parameters, such as Forward Transmitted Power and Reflected Power.

www.nevion.com

Media transport and broadcast infrastructure specialist, Nevion has expanded its monitoring solutions portfolio with the addition of its new TNS4200 Media Monitoring Probe. It is designed to monitor and analyze signals and streams for contribution and distribution applications. A single unit can simultaneously monitor hundreds of transport streams on IP/Ethernet and DVB-ASI, making it one of the most powerful, versatile and cost effective probes on the market today.

www.dtstech.com

DTS-UHD is the first audio format from DTS designed to deliver content featuring object-based audio tracks to consumers. It enables consumers to enjoy the benefits offered by object-based audio, including enhanced realism through more accurate spatial rendering, height audio elements, and customizations that adapt to any speaker layout. In addition to rendering object-based audio content, it supports complete compatibility for playback of DTS channel based content, providing the best audio experience from any content featuring DTS audio coding.

www.envivio.com

Envivio Muse software-based encoders are designed for live and on-demand encoding/transcoding and distribution to any device. They offer an IP-centric and IT-oriented approach to video transcoding and support HEVC, AVC, MPEG-2 services as well as iOS/Android/3GPP smartphones, tablets, PCs, gaming consoles, STBs and connected TVs. These encoders enable rich end-user experiences and provide the highest quality video, with support for picture-in-picture, alternative audio languages, closed captions, DVB-Subtitles and DVB-Teletext.


www.funke.nl

The Funke DSC550 4G LTE is an active antenna to receive digital terrestrial TV either indoors or outdoors depending on your location and distance from the TV signal transmitter. It provides a unique technical solution to guarantee TV signal reception that is free of 4G LTE interference. Its attractive, slim design makes this antenna blend perfectly into any interior. Yet it has also been designed for easy outdoor assembly and maximal durability.
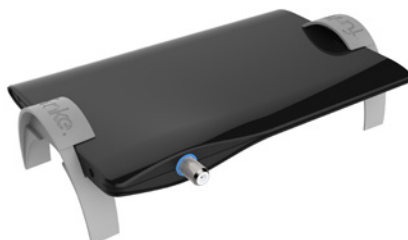
www.technicolor.com

Technicolor's MediaPlay DST839 claims to be the first satellite media server equipped with HEVC and Ultra HD 4k capabilities, allowing operators to significantly reduce the bandwidth consumption for video transmission and to offer additional channels. This media server processes premium 4k media content at a speed of 60 frames per second and thanks to its 8 tuner configuration, streams content wirelessly to client boxes and mobile devices connected via its advanced 802.11ac WiFi module.
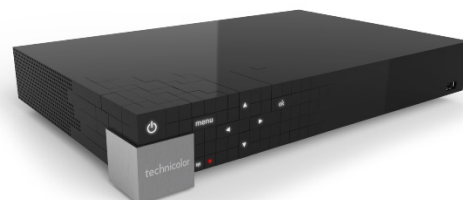
www.newtec.eu

The innovative Newtec Dialog platform secures the future of operators, giving them the power to make decisions on their technology of choice without having to worry about the constant evolution that marks the satellite market. The multiservice platform offers scalability and flexibility, allowing operators to build and adapt their infrastructure easily as their business changes and grows. It includes the new Mx-DMA technology, further enabling optimal modulation and bandwidth allocation and guaranteeing highest efficiency.

www.thomson-broadcast.com

Thomson Broadcast's Futhura series is an energy efficient full band TV transmitter range. It offers in a single cabinet up to 11.6 kW. Its leading edge design is constantly being improved to offer unique features such as DVB-T/DVB-T2/T2-Lite/M-PLP/Power Boost/Quality Boost/DAP. The range is scalable to any network topology and distribution network. Outstanding quality, stability and reliability are guaranteed thanks to in-house manufacturing and experienced engineering services.

www.work-microwave.de

WORK Microwave's DVB-S2 Broadcast Modulator combines video and IP technologies to provide a solution for IP network links and TV contribution. Its advanced feature set helps operators to get the most out of expensive satellite bandwidth, optimize data transport, and dramatically improve satellite signal quality. Innovative features include: DVB-S2 multi-stream, TSoIP, wideband (up to 80Mbaud) and carrier ID. The DVB-S2 Broadcast Modulator platform is designed to support the new extensions to DVB-S2.

www.roverinstruments.com

ROVER INSTRUMENTS 'new HDTAB7 advanced HD digital tablet analyzer for DVB-S/S2, DVB-T/T2/T2-Lite, DVB-C/C2, MPEG 2/4 and high resolution 7" TFT 16:10 touch display for HD pictures. It can measure BER, MER, PER, LDPC, quality, constellation, echoes, MER vs Carrier, spectrum and can be controlled remotely via LAN. Weighing 1.6Kg, including 5-hour Li-Ion polymer batteries, with its memory and PC interfacing capabilities, this device provides a solution for fast and efficient installations (ISDB-T, DMBT, 8VSB available).
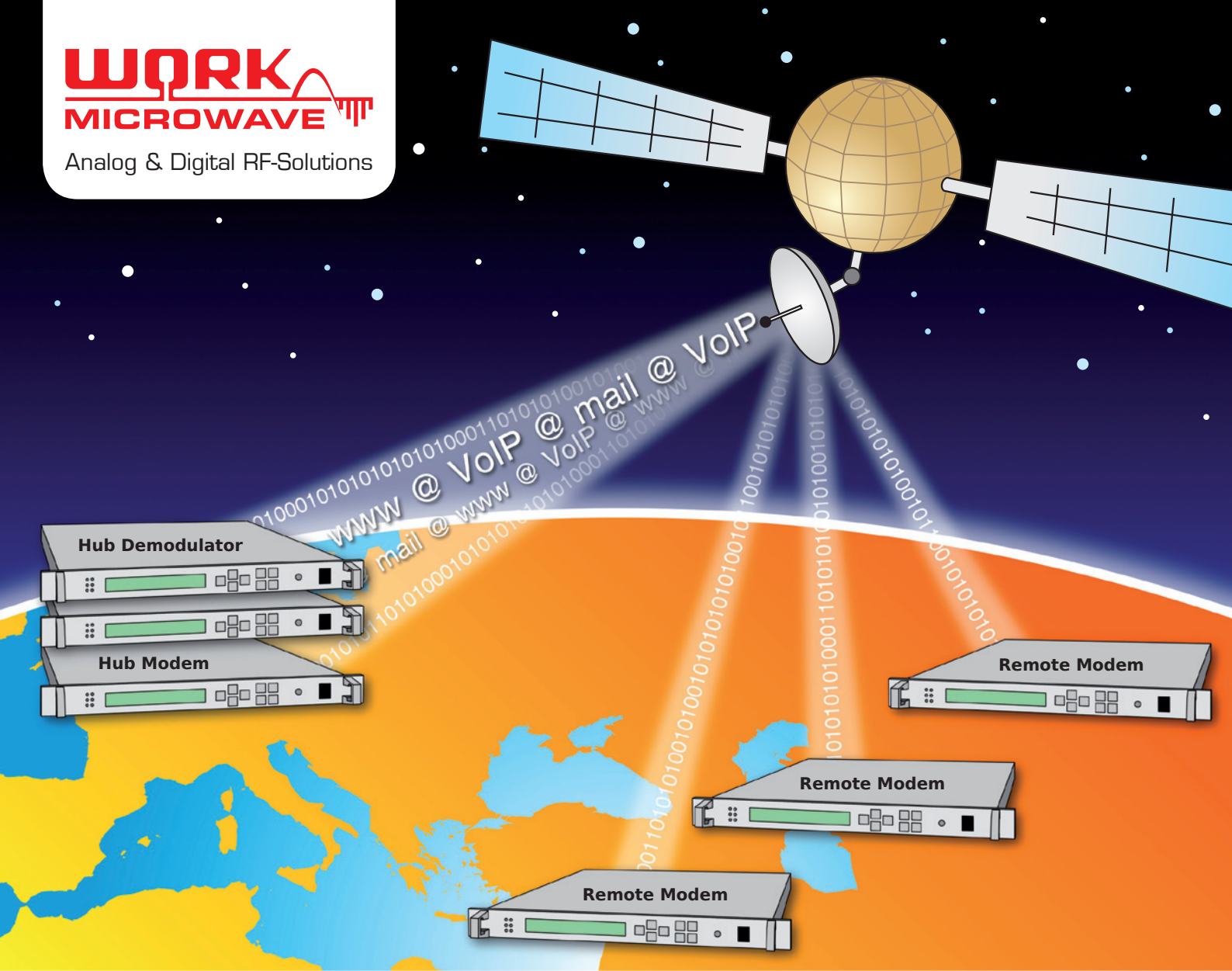
www.smardtv.com

SmarDTV, with Pico Digital, have developed a scalable and cost-effective solution for pay TV operators wishing to extend their services to the hospitality market. It enables the essential protection of content delivery to hotel rooms. The multi-stream professional CAM descrambles and re-encrypts AES 128-bit on the CI interface of the professional receiver which secures the content using DRM from the industry. The content remains encrypted from the operator streams up to each TV in the hotel room.