One Digital Radio across Europe

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The WorldDMB *Digital Radio Receiver Profiles* are designed to help create a vibrant digital radio market across Europe and beyond ... by defining minimum functionality for different classes of digital radio receivers that use the Eureka-147 family of standards. This provides a new level of confidence to all those involved in digital radio: to the broadcasters ... that the services they plan will be receivable; to the manufacturers ... that their technology investments will be supported by services; and to the consumers, knowing that their radio receiver will provide a consistent experience and assured levels of interoperability across Europe.

Creating the WorldDMB ***Receiver Profiles*** required new levels of understanding between broadcasters and receiver manufacturers, as well as agreement on the functions and features that could reasonably be included in digital radio receivers. The agreement has also removed some ambiguities that surrounded DAB/DAB+ and DMB, by harmonising the operation of the Eureka-147 family of standards. This offers a clearer set of propositions for digitizing radio, together with greater freedom for broadcasters and regulators to adapt digital radio in the future – without having to re-invent or change their chosen standard.

The process started at the 2008 EBU Technical Committee in Mainz (Germany) and was announced at IBC-2008 last September. Since then, a great deal of interest has been expressed by regulators, broadcasters and manufacturers – including the automobile industry – and there is a strong inertia behind this harmonised worldwide standard for digital radio.

Listeners are consumers

Historically, radio broadcasters have not been particularly concerned with the design of the radio devices on which their services are to be received. Broadcasting and manufacturing / retailing remained largely separate, and disconnected, aspects of the analogue world.

Now, however, with multimedia content being added to traditional audio, broadcasters have to understand why listeners would want to experience radio's rich new features and what it takes to motivate consumers to buy a new digital radio.

The role played by manufacturers and retailers is critical to any successful transition to digital radio and consequently this sector must be understood and nurtured by broadcasters.

When it comes to buying a new radio, consumers will spend less time considering the purchase than they do a TV or a mobile phone. For many years, analogue radios have been commodity items – cheap, basic and functional, and often bought as replacement items out of necessity rather than

desire. The radio itself may play a relatively minor role within a multifunction device (such as a music centre) and features available on the radio will be less important in the overall purchasing decision. Consumers have relatively low expectations for a radio receiver and this, in turn, is reflected by manufacturers who are less likely to produce exciting new radio models, and retailers that devote little shelf space to radio sets.

Digital radio must transform these long-standing consumer and trade perceptions, offering something new, exciting and desirable. But given radio's heritage, there is also a risk of alienation if digital radio is presented as something too radical or very different from consumer's expectations. Retailers must be persuaded to display digital radio products prominently and be educated to accurately promote the available products and services. A radio is a straightforward item – you buy it, open the box, turn it on ... and it works! This also applies to digital radios, although with an added expectation that it will work better because it is "digital". The gratification achieved by the consumer in discovering new radio stations, or making use of novel features, is at its most critical in the first few hours of use – the all important "out-of-the-box experience".

Whilst digital radio can meet all these expectations (as research from the UK and elsewhere testifies), there is a risk of the product failing to make the right first impression. It could be poorly engineered, overly cheap or have insufficient sensitivity to work properly in low field-strength areas. Either way, the user is likely to blame the radio first, the system technology second and the broadcaster last. It is the retailer who then has to deal with a disappointed consumer, and if the number of dissatisfied customers is high, the retailer will lose confidence and de-stock the product.

Broadcasters have a vital role to play in ensuring the consumer's expectations for the product are met or exceeded. This requires a robust digital radio signal, and the retailers have to be properly equipped and trained to give out accurate information about coverage and services. However, the manufacturer's ultimate commercial relationship lies with the retailer and not with the broadcaster. Digital radio products will only be sold if retailers identify consumer demand and place stock orders with the manufacturers. The broadcaster's role here is to create and sustain consumer demand with co-ordinated marketing campaigns in which both public and private broadcasters deliver the same core messages, identifying the benefits of digital radio.

Which digital platform?

That radio must go digital is beyond doubt. However, radio has quite a struggle to compete effectively against the richer content offerings available from TV, the internet, mobile phones and MP4 players. Advertisers are demanding that radio be more accountable, more responsive and more engaging – particularly amongst the younger audiences. The internet, TV and MP4 all have pictures and the opportunity for user-interaction. Radio must rise to this challenge.

A conundrum for broadcasters is that it is not clear yet whether "listeners" will demand a visual radio experience, interaction, time-shifting and content choices as diverse as that on the internet. The likelihood is that it will be some combination and, over time, their preference for types of service will evolve and mature. The platforms chosen to deliver digital radio must be capable of adapting to these trends so that radio remains competitive, relevant and viable.

Radio will be delivered over more than one platform – including fixed and mobile internet, and both digital and analogue broadcast networks, for some time to come. However, radio's ability to continue as a medium in its own right is at risk if it is expected to rely solely on third-party networks and distribution platforms for its primary distribution.

The key questions are:

- which of the new digital radio platforms will be dominant?
- which platform delivers the best economic case in terms of cost-per-listener?
- which platforms are fully scalable, and at what incremental cost to expand coverage, channels and content?

- which platform can adapt over time to meet new listener demands?
- which platform gives the broadcaster sufficient control to guarantee content delivery?
- which platform satisfies energy conservation and carbon emission requirements for both the broadcaster and listener?

Content, content, content

Regardless of the delivery method, digital radio must offer a compelling reason for consumers to buy a new receiver, and the number one reason is to *access more content*. Choice is an empowering message, an invitation to new adventures which is more powerful and compelling – especially where there are no ongoing costs or subscriptions.

Consumers are not particularly attracted, in advance, to the notion of achieving better technical quality than, say, FM or mp3. That is not to say the technical quality is unimportant, but the quality benefits tend to be appreciated *after* the purchase, not before. Furthermore, "quality" can mean many things in a consumer's mind, from lack of hiss and crackle (compared to FM), cleaner audio (i.e. more – or less – compression and/or fidelity) or simply the ease of changing from one station to another when compared to an analogue tuner. Only a very small percentage of radio listeners demand or appreciate audio fidelity at near-CD quality. This is not surprising given that most radio listening takes place in sub-optimal conditions. Many engineers feel uncomfortable with this issue but the economic success of a platform designed for mass consumption is far more important than satisfying a small minority of audiophiles (particularly where other platform options exist). Content remains the primary consideration for a successful new platform.

Regulating digital radio

The idea that digital radio delivers too much choice (i.e. competition) sometimes lies behind seemingly odd regulatory decisions, restrictive licensing regimes and delays in introducing digital radio. However, allowing incumbent broadcasters – who commit to digital radio – to operate additional digital channels has many virtues: the consumer benefits from more choice and the existing plurality of radio ownership remains largely stable (although allowing access to some new players undoubtedly stimulates competition). Having more radio channels appeals to advertisers and offers a better investment case for broadcasters to increase their portfolio of stations.

The role of public and private broadcasters is also key to success. A listener does not generally care whether their content comes from a PSB or a private operator but does care if their favoured content is not available on a particular platform. Regulators should ensure all broadcasters are encouraged to take up the platform and that they work together to ensure its success.

Whatever the regulatory model (it will differ from country to country), the objective should be to create a compelling proposition which serves three distinct communities – the broadcaster, the consumer and the manufacturer / retailer of digital radio products. Without these three legs, the platform will fall over.

Digital radio standards

Which digital radio standard should you choose? There are several terrestrial candidates, not to mention satellite and internet options. Many broadcasters, regulators and indeed manufacturers find themselves confused ... they commission one study after another but are still reluctant to make decisions for fear of choosing "the wrong one".

The key technologies relating to radio delivery platforms include:

❍ DRM (Digital Radio Mondiale)

An open standard with many similarities to DAB+, sharing the same audio codec, EPG, text services and certain commonality of carrier modulation. This implies adding DRM into a DAB+ receiver requires little more than an RF section and suitable antenna but, in reality, this is too simplistic and understates the manufacturing and market issues involved. When DRM achieves widespread domestic licensing for permanent services, consumer demand for DRM receivers should follow.

❍ Wireless and mobile internet radio

Although advances are being made in multicast delivery, internet radio services remain largely unicast. The scaling up of a national broadcaster's infrastructure to serve 20 million simultaneous listeners creates problems of bandwidth, cost and server installations. Network congestion is potentially the greater problem for streamed services, with contended connections occurring particularly at local telephone exchanges, on 3G wireless networks and within overloaded Wi-Fi spectrum. Moreover, the broadcaster has little or no control over delivery, with traffic priority being determined and managed by the network owners.

Consumers are required to pay for streamed bandwidth, particularly over 3G (three hours listening to a 64 kbit/s radio stream consumes about 100 MB). Using a computer solely or mainly to listen to radio is a growing green concern, with the average computer drawing 20 to 30 times more energy than a typical digital radio. Nevertheless, the internet has many advantages such as listen-again services, convenient for niche broadcasters and disparate audiences.

❍ HD Radio (IBOC) and Sirius XM satellite radio

One in seven of the USA's 14,000 terrestrial radio stations has HD Radio capability, with a handful of (mainly trial) installations outside the USA. This proprietary system offers a digital simulcast of the host analogue service and the possibility of one or two lesser-quality digital-only services and limited multimedia within the 100 to 150 kbit/s payload of FM IBOC. Estimates suggest that half-a-million HD radios have been produced to date, although prices remain high in comparison to analogue radios.

Sirius XM, the merged US satellite radio operation, has 19 million subscribers spread across the two systems, each paying around US$ 160 to 200 a year for the service. Seven satellites are supplemented by over a thousand terrestrial repeaters to provide urban indoor reception and gap filling. The company recently refinanced to avoid Chapter 11 bankruptcy.

❍ DAB, DAB+ and DMB

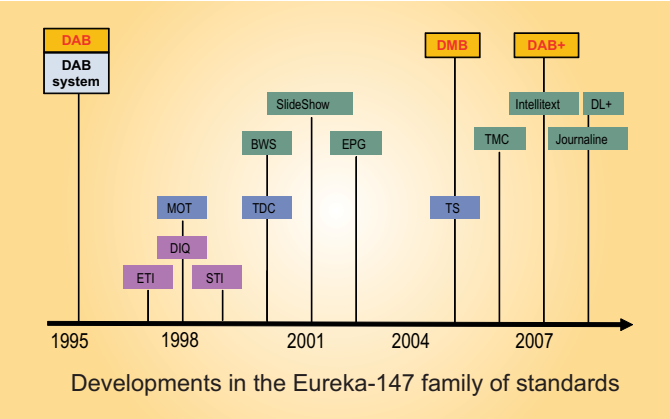
Often collectively referred to as the "Eureka-147 Family", this open standard has proved enduring and adaptable to the changing needs of broadcasters as well as technology developments. DAB and DAB+ offer an identical consumer experience – centred on radio – with text, slideshow, EPG and other multimedia features.

Abbreviations

AAC	Advanced Audio Coding	**EPG**	Electronic Programme Guide
DAB	Digital Audio Broadcasting (Eureka-147) http://www.worlddab.org/	**ETI**	(DAB) Ensemble Transport Interface
		GE06	Geneva Frequency Plan of 2006
DAB+	DAB using the AAC codec	**IBOC**	In-Band On-Channel
DMB	Digital Multimedia Broadcasting	**MIPS**	Million Instructions Per Second
EICTA	Trade organisation for promoting digital technologies in Europe – now known as **Digital Europe** http://www.eicta.org/	**PAD**	Programme-Associated Data
		PMP	Portable Multimedia Player
		RF	Radio-Frequency
		SFN	Single-Frequency Network

DAB allows eight to ten radio services within a 1.5 MHz multiplex (ensemble) whilst DAB+ (which uses the AAC codec) accommodates 20 to 25 radio services in the same spectrum.

DMB is primarily an H.264 mobile TV platform, sharing the same multiplex and carrier structure as DAB, which may also be used with slow frame rates for visual radio.



Developments in the Eureka-147 family of standards

Any combination of DAB, DAB+ and DMB services can be transmitted together in one (or more) multiplexes to provide a highly flexible and future-proofed solution for broadcasters.

The system employs single-frequency networks (SFNs) which have three distinct advantages:

1) a network can be tailored precisely to any national, regional or local requirement;
2) coverage can be extended at a rate which the business model can sustain, without additional spectrum demands;
3) if coverage hotspots, reception in subways or a particularly demanding quality of service are required, they can be provided by means of low-cost on-channel repeaters.

Consumer receivers are plentiful and cheap and there are now many chipset vendors from Europe, Korea and China offering solutions to radio manufacturers. Nearly 30 million receivers have been sold to date with approximately 250 DMB device models and nearly 1,000 different radio receivers. Consumer prices start as low as € 25. In the UK, Denmark and Korea, approximately one in three households owns a DAB or DMB receiver.

Services are commercially available in Belgium, China, Denmark, Germany, Malta, Norway, Singapore, South Korea, Spain, Switzerland and the UK. Other countries – including Australia, the Czech Republic, France, Ghana, Hong Kong, Hungary, Indonesia, Ireland, Israel, Italy, Kuwait, Malaysia and Vietnam – are already broadcasting or about to start full-time services, with many other countries engaged in successful trial phases.

In Europe, the GE06 planning conference, and digital television switchover, have made access to spectrum in Band III much easier, giving rise in effect to common spectrum for a pan-European digital radio system.

The shared nature of a multiplex enables the network and transmission costs to be shared by all the broadcasters and generally compares favourably with equivalent FM networks at a local level, but tends to be much less expensive per station than FM, on a regional and national scale. Multiplexing, equipment and distribution costs are reducing all the time (aided by WorldDMB's latest draft technical standard for distributing ETI streams over IP networks), thanks to new techniques and competition between manufacturers. Additional SFN transmitters to increase the range, coverage or field strength can be cost-effective and simple to engineer, particularly where active repeaters are used.

The combination of a strong broadcaster proposition, and the widest range of receiver products already available to major retailers, means that digital radio is viable, attractive and ready to deploy anywhere in the world. Those countries choosing the Eureka-147 family are doing so safe in the knowledge that the standard is adaptable for whatever the future of radio or mobile TV may hold.

DAB+ Digital Radio

Broadcasters want digital standards to remain stable for extended periods whilst consumers expect products they buy to carry on working for many years. But technology doesn't stand still and there is

always the potential for something better around the corner that will offer new benefits or give competition to a platform in rapidly changing markets.

WorldDMB remains a strong advocate of stability and any changes made to its standards over the years have been the result of careful consideration. DAB uses MPEG Audio Layer II coding which is now considered a mature technology. More efficient coding schemes and algorithms have since been devised, allowing audio with equivalent or better subjective quality to be broadcast at lower bitrates. Later technologies such as DVB-H and DRM make use of MPEG-4 standards which were also an obvious candidate for a more efficient version of DAB.

After rigorous examination of candidate options, WorldDMB selected the MPEG-4 HE-AAC v2 codec with a 960 transform that matches DRM and a frame structure designed to give the fastest possible channel-selection time ("zapping time"), along with robust continuous reception. Although other transport mechanisms such as IP were examined, these require significant data overheads and suffer service recovery and zapping-time issues, all of which mitigated against them.

The DAB+ standard was published in February 2007 as ETSI TS 102 563 *"Digital Audio Broadcasting (DAB);Transport of Advanced Audio Coding (AAC) audio"*.

The significantly increased efficiency of DAB+ offers benefits for governments and regulators (better spectrum efficiency), broadcasters (lower transmission costs per station) and the consumers (a greater choice of stations). DAB+ is designed to provide the same functionality as the current DAB MPEG Audio Layer II radio services, including service following between other ensembles or FM, traffic announcements, multimedia PAD (dynamic labels such as title, artist), news headlines, complementary graphics and images, etc.).

In some countries where DAB digital radio has already been launched, broadcasters are committed to continue using MPEG Audio Layer II. However, in countries still planning to launch digital radio, the arguments in favour of launching with DAB+ are compelling.

Digital Radio without Frontiers

Over the last two years, radio regulators have increasingly identified DAB+ as the way forward for digital radio, particularly where no previous DAB service has existed (such as Australia). Elsewhere, regulators are licensing DAB and DAB+ to coexist, ensuring the existing listener base is not disenfranchised (e.g. Switzerland and Germany). France's strategy for digital multimedia radio is based on DMB, similar to Korea, but with a stronger radio emphasis and a new interactive experience through BIFS (BInary Format for Scene description). Norway is in the process of combining DMB free-to-air mobile TV with its existing DAB networks and services, to provide a rich combination of radio and TV that is capable of being received on many different types of receiver including mobile phones.

Europe's highly mobile population and single market implies a common technical standard across the 27 member states and their immediate neighbours. However, national regulators have differing requirements of their broadcasters and no single pattern for digital radio was emerging across Europe. It became apparent that if all receivers were capable of decoding DAB, DAB+ and DMB, then the individual country choice would become less of an issue for the single market. However, making existing DAB/DAB+ receivers compatible with DMB, and vice versa, is neither a straightforward or quick process.

Chips, modules and receivers

The architecture of DAB radio receivers and chips differs substantially from DMB multimedia devices. Chips currently used for DAB receivers are not designed to render video, even at low frame rates. Similarly DMB receivers which, by and large, have been made for the Asian market,

are not engineered to decode DAB+ or some of the more common features of DAB that are familiar in Europe.

Creating the necessary compatibility amongst chipsets and devices requires changes to be made to existing chipsets, modules and receiver products. This affects the entire production chain through to the finished receiver – requiring additional product verification and testing, changes to production processes and increased costs. New, more powerful, chipsets require development times measured in years, and significant new investment which is only practical if the return on investment in current chipsets has been successfully completed.

Improving chipsets

Memory, processing power (MIPS) and chip architecture are highly optimized and, unless a feature is mandatory, manufacturers will not wish to design in unnecessary spare processing, redundant decoders (with additional royalties) or to spend several man-years writing new firmware without a proven market demand.

New chipsets to incorporate all DAB, DAB+ and DMB functions take 18 to 24 months to bring to market before being integrated into new modules and in turn into new radio devices. It is little wonder if manufacturers appear reluctant to meet broadcasters' requests for radios with screens, an EPG or other new features, particularly when there is unlikely to be a guarantee from broadcasters that the supporting services will create a certain product demand.

Established digital radio manufacturers, with heavy existing investments in their chipsets and modules, could not be expected to embark speculatively on entirely new chipsets and receiver modules to satisfy each country's chosen variant of the Eureka-147 family. Equally, it would be naive to assume that new chip and module vendors could develop brand new products *and* win a major share of the branded product market in just a year or two.

A different approach was required to ensure manufacturers could benefit from a single European market for digital radio receivers and remove the necessity for broadcasters or regulators to be confined to a subset of the Eureka-147 family of standards.

WorldDMB Digital Radio Receiver Profiles

In June 2008, a special Task Force – led by the WorldDMB Presidency – was established to create a unified, cross-industry approach to digital receivers. The Task Force included:

- country representatives from France, Germany, the UK and Korea:
- major broadcasters;
- leading manufacturers of receivers and silicon chipsets;
- the EBU;
- EICTA (the trade body representing European consumer electronics manufacturers, recently renamed *Digital Europe*);
- WorldDMB's Technical Committee.

The Task Force consulted widely during the process to ensure stakeholders had an opportunity to participate, as did the EBU and EICTA. In September 2008, WorldDMB published the *Digital Radio Receiver Profiles* in conjunction with the EBU and EICTA.

Digital Radio Receiver Profiles specifies the mini-mum requirements and features to be built into different classes of digital radio receiver, ensuring interoperability of new receivers and services across neighbouring countries whose broadcasters may be using any combination of DAB, DAB+ or DMB.

The manufacturing specifications comprise three hierarchical digital radio receiver profiles. In summary these are:

- **Profile 1:** Standard Radio Receiver for all audio services, with at least a basic text display. This class of receiver drives the price-sensitive mass market for radio devices;
- **Profile 2:** Rich Media Radio Receiver for table-top radios, with a colour screen – able to receive all audio services, along with advanced text and picture applications such as slideshow and graphics;
- **Profile 3:** Multimedia Receiver for devices such as mobile phones and personal media players – able to receive advanced forms of multimedia including mobile video.

Features and functions appropriate to in-car systems are also defined, including automatic retuning between digital and analogue services to ensure continuous reception, and advanced travel and traffic services for real-time satellite navigation.

As a result, new digital radios bought in France (DMB) can be expected to work equally well in neighbouring Germany and Switzerland (DAB and DAB+) or Italy (DAB, DAB+ and DMB) and vice versa. The receiver profiles apply to any country where the Eureka-147 family of standards is being licensed by regulators.

Profile 1

Standard Radio Receiver

Table-top/bedside/pocket/in-car

Simple text screen

- Receives all DAB, DAB+ and DMB audio
- Displays scrolling text
- Mass market receivers
- Prices from €25

Profile 2

Rich Media Radio Receiver

Colour screen

- Slideshow, BIFS,
- advanced text
- EPG , TPEG

Creates new kinds of radio

- Wifi, in-car, interactive
- Media storage, podcast

Profile 3

Advanced Multimedia Receiver

Decodes all DAB, DAB+ and DMB services

- DMB Video
- BIFS, EPG, TPEG

WorldDMB's *Digital Radio Receiver Profiles* are composed of **mandatory features** which must be implemented and **recommended features** which offer enhancements with wide appeal, and define the minimum functionality requirements of products within each profile. Manufacturers may offer additional features in order to differentiate their products ... but are only considered compliant if the features match all the requirements of a particular class of receiver.

Broadcasters may use the receiver profiles to plan services for maximum take-up and to help listeners make sensible purchasing decisions. Regulators will find the receiver profiles helpful in developing strategies and policies for digital radio within national boundaries and with reference to trans-national and harmonised markets.

In-car products are subject to the usual safety-related conditions – such as limited scrolling and limited access to services while driving, image-per-second limitations, etc. – according to the regulatory or industry requirements.

Products which do not meet the requirements of any profile may continue to be manufactured for established digital radio markets on a market-specific basis but it is thought these will quickly lose their appeal to the consumers and will be phased out.

The WorldDMB *Receiver Profiles* reflect receiver design issues and broadcaster capabilities that are appropriate for the current period and for the foreseeable future. However, technology advances and market developments are reviewed from time to time and would be reflected in the definition of future *Receiver Profiles*.

Cooperation

By developing the *Receiver Profile* characteristics in conjunction with the leading silicon and module vendors and with EICTA, broadcasters could better understand the complex manufacturing issues and product timescales. Wish lists of features the broadcasters would like to see in receivers were translated into realistic and deliverable manufacturing requirements, ensuring also that the cost of a digital radio module would not increase by more than a few tens of cents. This might not sound much but cost is critical and the Task Force would have been irresponsible to force the price of digital radios upwards unnecessarily. The manufacturers – in agreeing to invest in significant new R&D, production changes and variations – sought reassurance that a unified specification would increase the overall size of the market.

Reconciling the practical manufacturing issues was important for a successful outcome. One example involved decoding and processing the MPEG-4 container for DMB video and audio, even where only the audio is required for a simple radio. Decoding requires additional processing capability and increased memory, which either exceeds the capability of a chip designed primarily for radio, or adds considerably to the external components required, increasing the cost and power consumption of the module. It was necessary in this case to balance the maximum DMB bitrates that broadcasters could be expected to use for radio services against the chipset capabilities.

Multifunction products such as a mobile phone or PMP would have a multimedia video processor as the host and the radio decoding as a slave. But without the additional multimedia processor, the radio chip would be unable to operate on its own as a video-capable host processor.

By taking a real-world approach with the silicon and radio manufacturing industry and the broadcasters, the *Receiver Profiles* Task Force was able to define a set of functional specifications which satisfied both industries and would ensure universal receivers could enter production with little delay.

Production

Major receiver manufacturers are already producing the chipsets for combined DAB, DAB$^+$ or DMB receivers and, during 2009, these will begin to translate into consumer electronics products conforming to the *Receiver Profiles*, ensuring compatibility in many territories.

The receiver profiles define the *minimum* requirement of functions and features for each of the three classes of receiver, not the *maximum*. For example, a manufacturer might sell a receiver with a 320 x 240 pixel touchscreen rather than a simple dot-matrix display, yet it will remain a Profile 1 receiver unless it also has the ability to decode and display all Profile 2 content (slideshow, EPG, etc). Nevertheless, Profile 1 guarantees that a minimum level of content will be received and displayed, leaving the manufacturer free to enhance the product with a range of features relevant to the market.

Defining profile-compliant receivers in this manner ensures that broadcasters know for the first time how each class of receiver copes with their multimedia content, enabling them to target services at different types of receiver. Studio production resources to broadcast extra content can be managed in response to the volume of receiver types present in the market.

Regulators currently considering – or about to consider – their country's digital radio standards can do so now with much greater flexibility than was previously possible. A regulator may choose to specify one element of the standard, such as DAB$^+$, and in the future may license DMB without changing the infrastructure or overall standards. Broadcasters might add a DMB music video service, for example, knowing that the audio stream and PAD of the new DMB service will be receivable on existing DAB$^+$ radios, even those with only basic text displays (Profile 1), whilst the video component together with all radio services can be experienced on more advanced (Profile 3) devices.

Although the Task Force confined itself to working with the extant Eureka-147 standards, a number of clarifications and minor amendments to the standards have since been made to further aid harmonisation. These include clarification of how radio services should be implemented using DMB together with a DMB PAD structure which mirrors that already available through DAB and DAB+.

Interoperability

The *Receiver Profiles* are designed to apply to any country where the Eureka-147 family of standards is in use or will be licensed by regulators. The cross-industry Task Force responsible for developing the receiver profiles did consider other digital radio standards such as DRM. However, until such time as these other digital radio systems become widely licensed by regulators and similarly deployed, it is unrealistic to require manufacturers to include additional RF components, antennae or technologies, and bear an increase in royalty costs. Consumers would not be willing to pay more for their radios, in effect subsidising technologies they may be unable to use. Nevertheless, WorldDMB and the *Digital Radio Receiver Profiles* Task Force is open to approaches by other standards bodies to promote interoperability and increase the overall market for digital radio.

Internet radio

One of the most interesting recent developments is the appearance of combined DAB/DAB+ and internet radio receivers from some of the leading manufacturers. These radios deliver the best of both platforms, not having to rely on a continuous internet or Wi-Fi connection to receive radio programmes, whilst giving DAB/DAB+ a new level of interactivity through a back channel. By linking DAB/DAB+ with the internet, the door opens to various forms of content tagging, bookmarking and pulling additional information and advertising from the web, not to mention the possibilities of real-time audience measurement.

Conclusions

Radio still appears to be a strong and enduring media which appeals to all age groups, is able to be heard almost anywhere and, above all, is simple and convenient to use. However, radio now has to compete with a much greater array of electronic media, from TV to the internet, mobile phones to mp3 players. No broadcaster can predict exactly how the medium of radio will evolve over the next 10 to 15 years, but he can prepare by adapting his ability to reach audiences, whatever their age, their social patterns and methods of accessing radio. Broadcast radio remains the most compelling method of delivering content to large audiences at low cost, whilst ensuring that the broadcaster controls the delivery platform.

DAB, DAB+ and DMB offer broadcasters an armoury of content choices to suit almost any strategy for digital radio and mobile multimedia. The WorldDMB *Receiver Profiles* mean that broadcasters and regulators no longer have to commit to just one form of digital radio – they may now choose any combination of DAB, DAB+ or DMB and alter that choice in the future, confident that owners of compliant receivers will not be disenfranchised.

Transmission networks can be established to fit any business model and expanded or improved as and when the business case warrants it.

The desire for a successful digital radio market has been at the heart of the “Receiver Profiles” work. Its aim was to gain agreement between manufacturers and broadcasters on core features and functions, defined in a series of *Profiles* for three classes of receiver. Achieving widespread agreement on these receiver profiles through the Task Force is a major leap towards a truly harmonised digital

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As the CEO of multiplex operator Digital One, Mr Howard created the UK's first commercial DAB multiplex and ran the world's largest DAB radio network for ten years. His pioneering joint-venture with silicon manufacturers created the first low-cost DAB receiver chips and affordable consumer receivers. The same chip technology still dominates the DAB receiver market today.

An electrical and electronics graduate, Quentin Howard has worked in UK commercial broadcasting since the late 1970s and as a Chief Engineer and later Director of Engineering and Technology for the company which became the UK's largest radio group. Achievements include designing many technological breakthroughs for the industry, including the UK's first all-digital studios, the first radio satellite-distribution network and the first computer playout systems used in UK commercial radio. He was also responsible for the design and construction of Classic FM and its national network of FM transmitters.

radio market. It will enable broadcasters to adopt the Eureka-147 standards with greater confidence and removes a major barrier for the car manufacturers.

DAB+ offers the most efficient spectrum use and remains the preferred choice for digital radio broadcasters, whilst DMB offers a proven and attractive solution for mobile TV and video-based multimedia. Because these two systems can be combined together, in flexible and scalable networks, is a unique benefit no other digital system can match. Add to that the enormous range of receiver devices already available, and it is no wonder that the Eureka-147 family is the most popular and widely deployed digital multimedia and radio system in the world.

Further reading

WorldDMB "Receiver Profiles" document:

http://www.worlddab.org/public_documents/WorldDMB_Digital_Radio_Receiver_Profiles.pdf