2nd Generation Satellite

What is DVB-S2?

DVB-S2 (EN 302 307) is a digital satellite transmission system developed by the DVB Project. It makes use of the latest modulation and coding techniques to deliver performance that approaches the theoretical limit for such systems. Satellite transmission was the first area addressed by the DVB Project in 1993 and DVB standards form the basis of most satellite DTV services around the world today, and therefore of most digital TV in general. DVB-S2 will gradually replace DVB-S in the future, as new HD services entice users to upgrade their receivers to more efficient DVB-S2 models.

Background

The world's first digital satellite TV services were launched in Thailand and South Africa at the end of 1994 and both used the newly released DVB-S system. Over time it has become the most popular system for the delivery of digital satellite television, with well over 100 million receivers deployed around the world. Nonetheless, with the system being more than ten years old, it is not surprising that the industry eventually decided the time was right to update. Thus DVB-S2 was developed, with the DVB Technical Module sub-group responsible for the work being chaired by Dr. Alberto Morello of RAI. The work would take advantage of advanced techniques for channel coding, modulation and error correction to create a system that would make a range of new services commercially viable for the first time, e.g., when combined with the latest video compression technology, DVB-S2 would enable the widespread commercial launch of HDTV services.

How does it work?

The original DVB-S system, on which DVB-S2 is based, specifies the use of QPSK modulation along with various tools for channel coding and error correction. Further additions were made with the emergence of DVB-DSNG (Digital Satellite News Gathering), for example allowing the use of 8PSK and 16QAM modulation. DVB-S2 benefits from more recent developments and has the following key technical characteristics:

- There are **four modulation modes** available, with QPSK and 8PSK intended for broadcast applications in non-linear satellite transponders driven close to saturation. 16APSK and 32APSK, requiring a higher level of C/N, are mainly targeted at professional applications such as news gathering and interactive services.
- DVB-S2 uses a very powerful **Forward Error Correction** scheme (FEC), a key factor in allowing the achievement of excellent performance in the presence of high levels of noise and interference. The FEC system is based on concatenation of BCH (Bose-Chaudhuri-Hcquengham) with LDPC (Low Density Parity Check) inner coding.
- **Adaptive Coding and Modulation** (ACM) allows the transmission parameters to be changed on a frame by frame basis depending on the particular conditions of the delivery path for each individual user. It is mainly targeted to unicasting interactive services and to point-to-point professional applications.
- DVB-S2 offers **optional backwards compatible** modes that use hierarchical modulation to allow legacy DVB-S receivers to continue to operate, whilst providing additional capacity and services to newer receivers.

Satellite EIRP (dBW)	51		53.7	
System	**DVB-S**	**DVB-S2**	**DVB-S**	**DVB-S2**
Modulation & Coding	QPSK 2/3	QPSK 3/4	QPSK 7/8	8PSK 2/3
Symbol Rate (Mbaud)	27.5 (α = 0.35)	30.9 (α = 0.2)	27.5 (α = 0.35)	29.7 (α = 0.25)
C/N (in 27.5MHz) (dB)	5.1	5.1	7.8	7.8
Useful Bitrate (Mbit/s)	**33.8**	**46 (gain = 36%)**	**44.4**	**58.8 (gain = 32%)**
Number of SDTV Programmes	7 MPEG-2 15 AVC	10 MPEG-2 21 AVC	10 MPEG-2 20 AVC	13 MPEG-2 26 AVC
Number of HDTV Programmes	1-2 MPEG-2 3-4 AVC	2 MPEG-2 5 AVC	2 MPEG-2 5 AVC	3 MPEG-2 6 AVC

Figure 1. Example comparison between DVB-S and DVB-S2 for TV broadcasting (Source: EBU Technical Review 10/04)

How does it work? (continued)

DVB-S2 delivers excellent performance, coming close to the Shannon limit, the theoretical maximum information transfer rate in a channel for a given noise level. It can operate at carrier-to-noise ratios from -2dB (i.e., below the noise floor) with QPSK, through to +16dB using 32APSK. The table overleaf (Figure 1) shows the improvements in efficiency that DVB-S2 delivers when compared to DVB-S with typical TV broadcast parameters, with gains in the useful bitrate of more than 30% in each case.

Market Deployment

Having been formally published as an ETSI standard in March 2005, DVB-S2 was quickly adopted by the industry for the delivery of new services. In Europe and the USA a number of major satellite broadcasters use DVB-S2, in conjunction with MPEG-4 advanced video coding, for the delivery of HDTV services (e.g., BSkyB in the UK and Ireland, Premiere in Germany, Sky in Italy, DirecTV in the USA). DVB-S2 has also been deployed by DTH operators elsewhere in the Americas, in Asia, the Middle East and Africa, creating a global deployment base of more than 250 million DVB-S/S2 receivers.

Two significant factors have contributed to the success of DVB-S2. Firstly, in August of 2006 the ITU's (International Telecommunications Union) study group on satellite delivery issued a recommendation that DVB-S2 alone be adapted as the preferred option for a "Digital Satellite Broadcasting System with Flexible Configuration (Television, Sound and Data)" (ITU recommendation number BO.1784).

Secondly, late in 2006, an announcement from the holders of key DVB-S2 intellectual property rights indicated that licensing costs for manufacturers of DVB-S2 equipment would not exceed $1.00 per consumer device, or $0.50 for quantities exceeding 500,000. The certainty granted by this announcement fostered the rapid adoption of DVB-S2 by the global satellite broadcasting and telecommunications industries.

DVB-S2 has also been adopted for professional applications. The EBU's Eurovision network, one of the world's largest contribution networks, has been fully upgraded from DVB-S to DVB-S2. Testing of the new systems in spring 2005 revealed a 20% increase in throughput, a result which encouraged the EBU to upgrade the network in time to distribute, for example, the 2006 FIFA World Cup over DVB-S2.

Next Steps

The technical work on DVB-S2 is still progressing. In July 2012 the DVB Project approved a new version of the specification that adds new technology to facilitate the reception of wideband signals (e.g. 200 MHz or 500 MHz). In addition, the DVB-S2 group is currently working on further DVB-S2 extensions.

Links

www.dvb.org	The main website of the DVB Project
www.dvbservices.com	Register here to download all the DVB and DVB sub-brand logos.
www.ebu.ch	
www.itu.int	