Digital Terrestrial Television

What is DVB-T?

DVB-T is a technical standard, developed by the DVB Project, that specifies the framing structure, channel coding and modulation for digital terrestrial television (DTT) broadcasting. The first version of the standard was published in March 1997 and in the twelve years since then it has become the most widely adopted DTT system in the world, with nearly 200 million receivers sold in more than 40 countries. It is a flexible system that allows networks to be designed for the delivery of a wide range of services, from HDTV to multichannel SDTV, fixed, portable, mobile, and even handheld reception. The DVB Project has now created a next generation terrestrial specification, DVB-T2, designed to meet the needs of countries after they have completed Analogue Switch-Off (ASO). (See separate DVB-T2 Fact Sheet.)

Background

When the DVB Project began its work in 1993, the development of standards for the cable and satellite markets was prioritised. Fewer technical problems and a more simple regulatory climate meant that services based on these standards could be launched quite quickly. Indeed, the industry saw solutions for digital satellite and cable broadcasting as a higher priority that those for DTT. The development of a system for DTT would present more challenges, being required to cope with a variety of noise and bandwidth environments and multipath interference. As with all DVB specifications a set of Commercial Requirements was drawn up to define how such a system should perform, and DVB-T was desinged to meet these requirements.

How does it work?

DVB-T, in common with almost all modern terrestrial transmission systems, uses OFDM (orthogonal frequency division multiplex) modulation. This type of modulation, which uses a large number of sub-carriers, delivers a robust signal that has the ability to deal with very severe channel conditions. DVB-T has technical characteristics that make it a very flexible system:

- 3 modulation options (QPSK, 16QAM, 64QAM)
- 5 different FEC (forward error correction) rates
- 4 Guard Interval options
- Choice of 2k or 8k carriers
- Can operate in 6, 7 or 8MHz channel bandwidths (with video at 50Hz or 60Hz)

Using different combinations of the above parameters a DVB-T network can be designed to match the requirements of the network operator, finding the right balance between robustness and capacity. Networks can be designed to deliver a whole range of services: SDTV, radio, interactive services, HDTV and, using multi-protocol encapsulation, even IP datacasting.

Whilst not originally designed to target mobile receivers, DVB-T performance is such that mobile reception is not only possible, but forms the basis of some commercial services. The use of a diversity receiver with two antennas gives a typical improvement of 5 dB in the home and a 50% reduction in errors is expected in a car. The DVB-H system for mobile TV was built on the proven mobile performance of DVB-T.

The use of OFDM modulation with the appropriate “guard interval” allows DVB-T to provide a valuable tool for regulators and operators in the form of the “single frequency network” (SFN). An SFN is a network where a number of transmitters operate on the same RF frequency. An SFN can cover a country, such as in Spain, or be used to enhance in-door coverage using a simple “gap-filler”.

One final technical aspect of DVB-T worth mentioning is its capacity for Hierarchical Modulation. Using this technique, two completely separate data streams are modulated onto a single DVB-T signal. A “High Priority” (HP) stream is embedded within a “Low Priority” (LP) stream. Broadcasters can thus target two different types of receiver with two completely different services. For example, DVB-H mobile TV services optimised for more difficult reception conditions could be placed in the HP stream, with HDTV services targeted to fixed antennas delivered in the LP stream.

Market Deployment

DVB-T services are on air in more than 40 countries and nearly 200 million receivers have been sold, of which 150 million in Europe alone. The most successful markets, with DVB-T receivers readily available for less than EUR 20, include the UK, Germany, France, Spain, Italy and Australia. (See Figure 1.) Each year sees the launch of services in more countries and there are trial broadcasts on air across the world.

Country	Population (million)	DVB-T Services Launched	Receivers Sold (million to nearest 0.5)
United Kingdom	60	1998 (2002 Freeview)	46
Spain	45	2000	30
Italy	59	2004	29
France	64	2005	17.5
Germany	82	2002	16
Australia	21	2001	2.5
Taiwan	30	2005	2.5

Figure 1. The most successful DVB-T markets (Dec. 2009)

Significantly, there are now a number of countries using DVB-T in conjuction with H.264/AVC MPEG-4 video coding for the delivery of HDTV services over DVB-T. These include Denmark, Estonia, France, Hungary, Italy, Norway and Singapore. DVB-T launches in Ireland, Portugal, Slovenia, and elsewhere in the near future will help to drive down the price of MPEG-4 receivers.

The ITU international frequency planning conference Geneva in 2006 resulted in a new agreement, GE06, signed by more than 100 countries in Europe, Africa and the Middle East. All of the signatories to this agreement will ultimately deploy DVB-T (or DVB-T2). This brings the total number of countries that have adopted DVB-T to around 120. The standard is also being adopted extensively outside these areas. Services are on air in Taiwan and Vietnam, and the system has been adopted in Colombia, Uruguay, India, Malaysia, Indonesia and elsewhere. Following an April 2007 agreement amongst ASEAN broadcasters, the likelihood is that DVB-T will be adopted right across Southeast Asia, a region with a population of more than 500 million people.

Next Steps for DVB-T

DVB-T is a complete solution for DTT, with the flexibility and capacity to deliver a whole range of services, in a range of channel bandwidths. It will continue to be the system of choice for the launch of new services for years to come, with consumers benefiting from the huge economies of scale that open standards bring to growing markets. For a number of countries, however, analogue switch-off is approaching in the next couple of years, and with it the release of valuable UHF spectrum. This transition will create a window of opportunity for the introduction of new technologies. DVB-T2, the second generation system for terrestrial broadcasting, will facilitate the introduction of such new services, taking advantage of advances in modulation and coding technology. (See separate Fact Sheet)

Links

www.dvb.org	The main website of the DVB Project
www.digitag.org	Sister organisation of the DVB Project, dedicated to facilitating the implementation DVB-T. See in particular, under DTT Resources, a list of links to country-specific organisations for DVB-T implementation.