

DIGITAL TELEVISION

1.0 INTRODUCTION

In the late 90s, world governments through ITU officially committed to replacing analog television broadcasting with digital television in the first few years of the 21st century. Portions of the radio-frequency spectrum have been set aside for television stations to begin broadcasting programs digitally, in parallel with their conventional broadcasts. At some point, when it appears that the market will accept the change, plans call for broadcasters to relinquish their old conventional television channels and to broadcast solely in the new digital channels. As is the case with compatible colour television, the digital world is divided between competing standards: the Advanced Television Standards Committee (ATSC) system, approved in 1996 by the FCC as the standard for digital television in the United States; and Digital Video Broadcasting (DVB), the system adopted by a European consortium in 1993.

The process of converting a conventional analog television signal to a digital format involves the steps of sampling, quantization, and binary encoding. These steps, described in the article telecommunication, result in a digital signal that requires many times the bandwidth of the original wave form. For example, the NTSC colour signal is based on 483 lines of 720 picture elements (pixels) each. With eight bits being used to encode the luminance information and another eight bits the chrominance information, an overall transmission rate of 162 million bits per second would be needed for the digitized television signal. This would require a bandwidth of about 80 megahertz—far more capacity than the six megahertz allocated for a channel in the NTSC system.

To fit digital broadcasts into the existing six- and eight-megahertz channels employed in analog television, both the ATSC and the DVB system “compress” bit rates by eliminating redundant picture information from the signal. Both systems employ MPEG-2, an international standard first proposed in 1994 by the Moving Picture Experts Group for the compression of digital video signals for broadcast and for recording on digital video disc. The MPEG-2 standard utilizes techniques for both intra-picture and inter-picture compression. Intra-picture compression is based on the elimination of spatial detail and redundancy within a picture; inter-picture compression is based on the prediction of changes from one picture to another so that only the changes are transmitted. This kind of redundancy reduction compresses the digital television signal to about 4 million bits per second—easily enough to allow multiple standard-definition programs to be broadcast simultaneously in a single channel. (Indeed, MPEG compression is employed in direct broadcast satellite television to transmit almost 200 programs simultaneously. The same technique can be used in cable systems to send as many as 500 programs to subscribers.)

However, compression is a compromise with quality. Certain artifacts can occur that may be noticeable and bothersome to some viewers, such as blurring of movement in large areas, harsh edge boundaries, and an overall reduction of resolution.

2.0 DIGITAL VIDEO BROADCASTING (DVB)

Digital Video Broadcasting (DVB) is a set of international open standards for digital television maintained by the DVB Project, an international industry consortium, and are published by a Joint Technical Committee (JTC) of the European Telecommunications Standards Institute (ETSI), European Committee for Electrotechnical Standardization (CENELEC) and European Broadcasting Union (EBU).

The DVB standards are for different media as follows.

- (a) **Satellite:** DVB-S, DVB-S2 and DVB-SH
- (b) **Cable:** DVB-C, DVB-C2
- (c) **Terrestrial television:** DVB-T, DVB-T2
- (d) **Smart TV:** DVB-SMATV
- (e) **Digital terrestrial television for handhelds:** DVB-H, DVB-SH

These standards define the physical layer and data link layer of the distribution system. All data is transmitted in MPEG transport streams.

2.1 DVB-T

DVB-T (Digital Video Broadcasting — Terrestrial) is the DVB European-based consortium standard for the broadcast transmission of digital terrestrial television that was first published in 1997 and first broadcast in the UK in 1998. This system transmits compressed digital audio, digital video and other data in an MPEG transport stream, using Orthogonal Frequency-Division Multiplexing (OFDM) modulation. It is also the format widely used worldwide (including North America) for Electronic News Gathering for transmission of video and audio from a mobile newsgathering vehicle to a central receive point; and by Amateur television operators.

Rather than carrying one data carrier on a single radio frequency (RF) channel, OFDM works by splitting the digital data stream into a large number of slower digital streams, each of which digitally modulates a set of closely spaced adjacent sub-carrier frequencies. In the case of DVB-T, there are two choices for the number of carriers known as 2K-mode or 8K-mode. These are actually 1,705 or 6,817 sub-carriers that are approximately 4 kHz or 1 kHz apart.

DVB-T uses three different modulation schemes (QPSK, 16QAM, 64QAM).

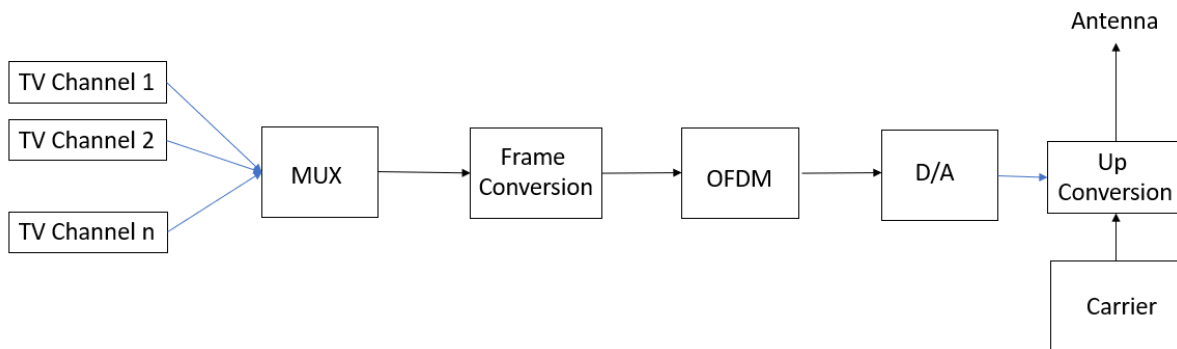


Figure 1. Block diagram of DVB-T Transmitter

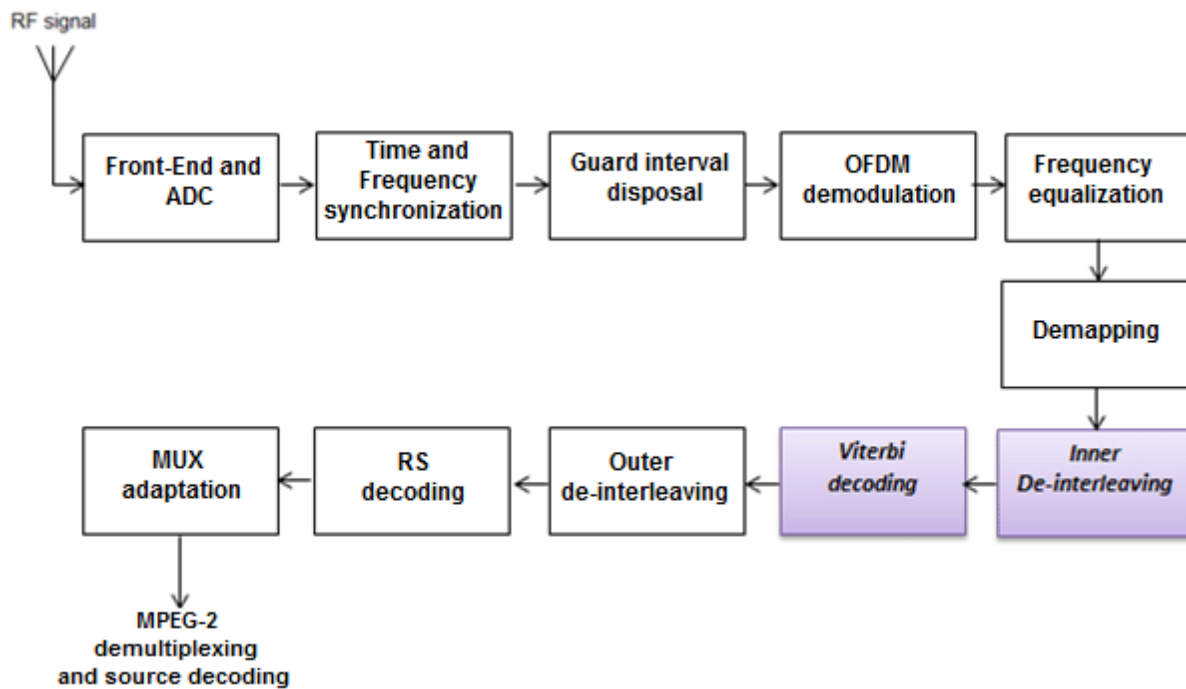


Figure 2. Block diagram of DVB-T receiver

2.2 DVB-T2

DVB-T2 is an abbreviation for "Digital Video Broadcasting — Second Generation Terrestrial"; it is the extension of the television standard DVB-T, issued by the consortium DVB, devised for the broadcast transmission of digital terrestrial television. DVB has been standardized by ETSI.

This system transmits compressed digital audio, video, and other data in "physical layer pipes" (PLPs), using OFDM modulation with concatenated channel coding and interleaving. The higher offered bit rate, with respect to its

predecessor DVB-T, makes it a system suited for carrying HDTV signals on the terrestrial TV channel (though many broadcasters still use plain DVB-T for this purpose).

3. DIGITAL MIGRATION IN KENYA

Kenya adopted the DVB-T2 standard and completed its digital migration process on 30th June 2014. Twenty transmitters have been installed and are on air at: Lamu, Kitui, MbuiNzau (Makueni), Namanga (Kajiado), wajir, Nyamninia (Siaya), Vuria (TaitaTavetta), Nyadundo (Nyandarua), Nyambene, (Embu/Meru/Isiolo), Webuye, Londiani, Mandera, Maralla, Marsabit, Garsen, Lodwar, Lokichogio, Kakamega and Homa Bay.

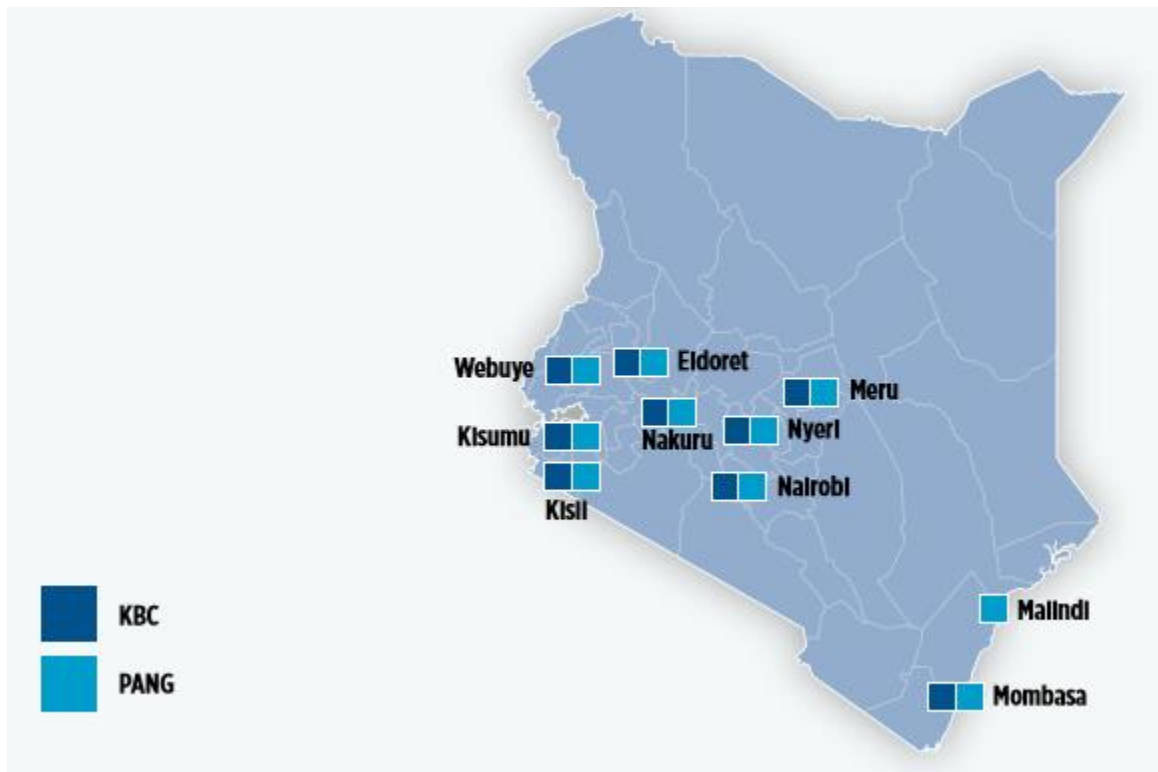


Figure 3. Digital Signal Availability (2017)