

Digital broadcasting technology and its effectiveness in the local and international television image

Assist. Prof. Dr. Ahmed Abdel Azem Mahmoud

Assistant Professor, Department of Photography, cinema and Television

Faculty of Applied Arts - October 6 University

ahmedabdelazem.art@o6u.edu.eg

Introduction

Technological development plays an important and fundamental role in many areas, specifically in the world of communications, which has become an important and main part in our lives and has increased its importance by the technological development in the video image industry, as well as the revolution in various social media, and to obtain the digital video image in its final form through various means of display. The technology of various television broadcasts of the video image is considered one of the most important stages of the technology of the image industry, which has advanced a lot in the recent period significantly as a result of digital transformation and communication technology, which is what the study will try to address to find out the latest developments in broadcasting technology and its effectiveness in the video image globally and locally.

Research problem:

The problem of the study lies in the confusion between the concepts of multiple broadcasting systems and the lack of technical foundations and rules for those systems to ensure obtaining the highest possible quality on different television screens, as well as identifying the extent to which the different digital broadcasting systems can be activated locally and globally and how to determine the appropriate broadcasting medium for television content. Display method and equipment used

Research questions:

- 1- What is the technological development that occurred in the various television broadcasts locally and globally?
- 2-What is the difference between broadcasting and streaming? and what are the stages of broadcasting a video signal until it is displayed on the screen?
- 3-What are the methods and types of television broadcasting? What the differences between them? and what is the relationship between television broadcasting and picture quality?
- 4-What are the reasons for choosing digital terrestrial television broadcasting networks? and what are the requirements for their implementation and their relationship to satellites?

Research importance:

The importance of the research is due to the identification of the different technologies for broadcasting the video image across different platforms and the effectiveness of communications and satellite technology in developing broadcast operations.

ReSearch objective:

The research aims to clarify the differences between the technology of different television broadcasting systems and their impact on the quality of the video image, and to highlight the extent to which the latest broadcasting technology can be applied locally and globally, and the extent of the development of interactive television systems with the development of television broadcasting technology, and to clarify the areas most affected by the development of digital television broadcasting technology.

Research Methodology:

The research follows the descriptive analytical approach based on the definition, description and explanation of the technology of different television broadcasting systems in an attempt to reach the highest levels of quality in the digital video image displayed on various display platforms.

Broadcasting process and its economic models

Broadcasting is the process of distributing audio or video content to an audience through any means of electronic mass communication, and it usually uses the electromagnetic spectrum in a form from one sender to several receivers, and there are several means to provide financial support for continuous broadcasting, including: commercial broadcasting, public broadcasting and community broadcasting. There is a difference between broadcasting and transmissions. Broadcasting is the transmission of a message or signal via radio waves or any electronic means, while transmission is the transmission of something from one person or place to another. Historically, there were several methods used to broadcast audio and visual electronic media to the general public, including Telephone broadcasting, radio broadcasting, television broadcasting, cable radio, cable television, live broadcasting, Internet broadcasting for video and television.

The Path to the Video

Digital video is a series of images that are displayed over time. Each image of a digital video sequence is a two-dimensional projection of a three-dimensional world. To think of broadcasting a video signal, take into account that the data rates of uncompressed digital video signals are 270 Mbps in SDTV, and 12 Gb per second in UHD TV, so the rate of this data is very high for its ability to store and the bandwidth is very high for its ability to transmit, so this data must be compressed to reduce its size and this process is called coding, and video compression is usually achieved by exploiting four types of iterations: Perceptual, temporal and spatial Statistical repetition. After reaching the final form, the video image passes through several stages that can be combined into three basic stages: the signal preparation stage, the distribution stage, and the broadcasting stage.

TV Contribution

It is all the processing that the video signal has undergone from its capture at the source until it is sent to the broadcast end where it is transmitted to the end user so the goal is to allow multiple decoding operations (Multi-Generation) with minimal loss of quality.

TV Distribution

Distribution links are used to transmit the video signal from the final production centers, which is the end of the processing stage, to the final parties that will carry out the broadcast through different media to the end users. Figure (1) shows the status of the DTTV broadcast

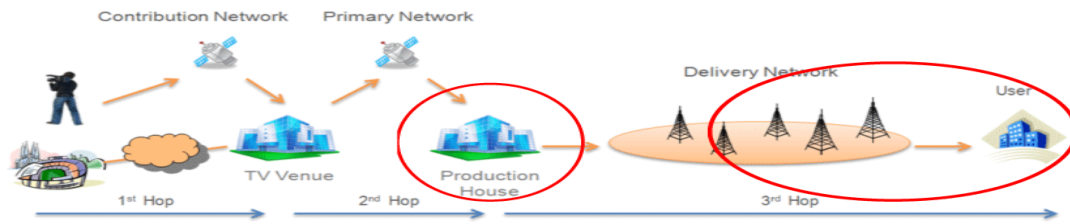


Figure (1) shows the status of DTTV

TV Broadcasting

The last stage in the video path chain is the transmission of audio-visual signals to the end user and television broadcasting is a form of radio transmission of radio signals from transmitters to antenna receivers that produce video images through television that can be tuned by people and specified by television stations OVER THE AIR OTA, TV broadcasting is known in the form of IPTV or OTT over the top as streaming service

Digital Terrestrial Television Broadcasting (DTTB)

Digital broadcasting is a broadcast technology based on the transmission of audio visual information by means of a bit stream. The broadcast signal consists of video and audio and also includes data services. The most dynamic and technically complex environment for the distribution of TV content is digital terrestrial television broadcasting. DTTB is generally regarded as the most Importance for the future of television broadcasting because it is wireless and supports receivers that can move and expand without limits and is able to provide local content geographically and in a timely manner and supports free subscription services and direct broadcasting. Figure (2) shows a model of **DTTB** system.

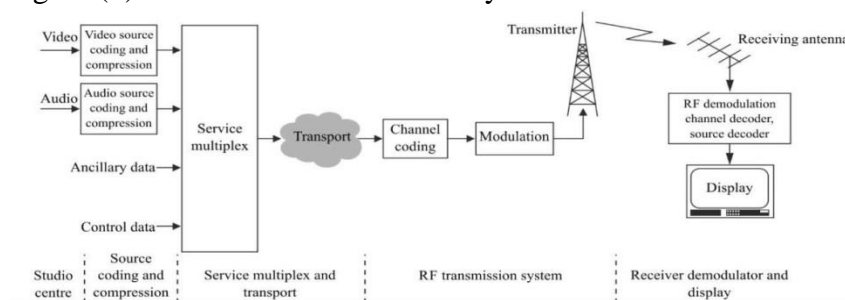


Figure (2) shows an example of a digital television broadcasting system

There are many reasons for choosing DTTB, the most important of which are its security and censorship control, its ease of use and simplicity of installation. It is also very efficient in spectrum use thanks to the use of advanced video compression and modulation techniques and single frequency networks for HDTV distribution, UHDTV terrestrial broadcasting systems such as HbbTV or Hybridcast offer interactive broadband broadcasting experiences new user DTTB can be distributed at home over Wi-Fi using existing technologies.

Digital Terrestrial Television Broadcasting Technology DTTB

Encoded DTTB signals are distributed between studios and encoders and then to transmission sites and are often distributed as MPEG-2 or MPEG-4 transport streams to ensure stable transmission rate synchronization although in the future they may evolve into HEVC or IP transport streams, and possible technology options for Distribution networks are optical fiber, coaxial cable, satellite, microwave and twisted pair through PDH, SDH ATM, DVB, IP or a combination of them. These networks consist of a group of transmitters and repeaters operating from ten kilowatts to only a few watts. DTTB with existing TV channels 6, 7 and 8 MHz and the choice of broadcast system will depend on specific conditions such as spectrum availability, coverage requirements, current network structure and reception conditions. There are many current systems available to implement a DTTB network which are :ATSC \ DVB-T \ DVB-T2 \ DVB-T2 Lite \ DTMB \ DTMB- Advanced \ DVB-H \ SH \ ISDB-T \ RAVIS

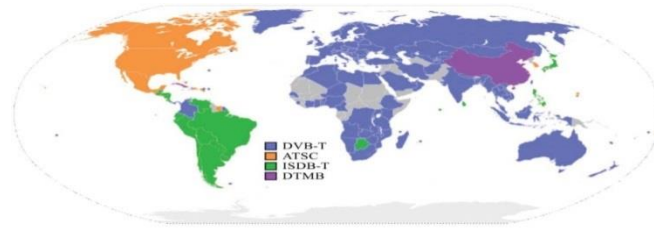


Figure (3) shows the distribution of DTTB in different regions

The role of satellites in digital terrestrial television broadcasting technology

A satellite is a device that orbits the Earth that is used to receive and transmit a signal. Each satellite contains a number of transmitters and receivers. Fixed (FSS) and mobile (MSS) satellites are of great importance for the terrestrial television broadcasting service as they can be used to feed DTTB transmission networks as they are useful As return channels in interactive television in cases where other communication networks are not available.

Using satellites as IP return channels for interactive television

Televisions have expanded their capabilities to become a more general interface for selecting and retrieving content. Various media such as broadcast television and two-way communication networks have cooperated for many years. Collaboration in communications and broadcasting services allows for interaction and customization by connecting modern televisions to a communications network, usually an IP network in addition to a broadcast network. The typical application of this is integrated broadcast-broadband (IBB) systems where broadcast content is sent over a one-way broadcast network and additional multimedia content is received over two-way broadband networks, maximizing the user experience by providing services High quality, flexible, interactive and personalized such as additional information about TV programs or additional services for minorities and people with special needs and non-linear broadcasting i.e. to watch missed programmes, most current TV sets are equipped with TV tuners for one or more types of broadcast distribution (cable, satellite, terrestrial) and provide interfaces For IP networks (WLAN, Ethernet, etc. and IBB systems as follows : HbbTV Hybrid broadcast broadband television, Hybridcast, smart TV platform based on HTML5 , IBB system,

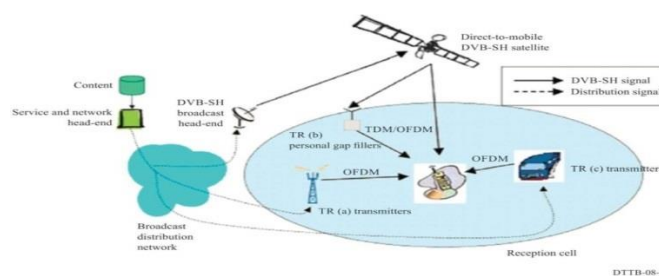


Figure (4) shows an example of an integrated terrestrial network and mobile satellites

Mobile TV

OTT is a term used to describe video delivery over the Internet primarily and this is provided over a high-speed Internet connection rather than a cable or satellite service provider. Among the various mobile TV broadcasting technologies we can find the following: DVB-H TV over IP, DVB-H over IP, UMTS, LTE, Mobile

The history of satellite broadcasting in Egypt and the Arab world

In the Arab world, the first television broadcast was recorded in 1956 in three Arab countries: Iraq, Lebanon, and Algeria, respectively. In Egypt, television broadcasting began on July 21, 1960. Egypt is the first Arab country to establish a government satellite channel in December 1990, and in April 1998 Egypt became the first Arab country that owns a Nilesat satellite, and private satellite channels in Egypt began broadcasting it in 2001 with the Dream and Mehwar channels, then the rest of the channels rolled

The Egyptian satellite Nilesat

The Egyptian Company for Satellites Nilesat is an Egyptian satellite company specialized in television and radio broadcasting services. It was established in 1996 to be committed to providing a high-quality, credible digital television service, in addition to providing radio and information network services, which aims to serve the Middle East and Africa.

Nilesat provides digital radio and television broadcasting services in the coverage area of its satellites, and the content that is broadcast via satellite or through optical fibers can be delivered from the studios of the Egyptian Media Production City to be sent to the main Nilesat center in Cairo, where the content is prepared after receiving it to be broadcast to the Nile satellites Sat through the uplink to be presented and presented to viewers. Nilesat currently broadcasts 700 TV channels, most of which are broadcast to the wide coverage area with a common language and culture, and high-quality channels are broadcast via the digital Nilesat platform that broadcasts channels using digital compression techniques H.264/ Advanced AVC, and in the field of digital broadcasting via satellite, the Nilesat digital playback platform has the necessary technologies to launch and operate high-quality channels (UHDTV/4K), and Nilesat has a complete platform for broadcasting Internet TV Streaming, which enables it to broadcast and receive TV programs with a quality similar to the broadcast quality. The usual satellite through the infrastructure of the Internet, which is connected directly to the user in a live or remote image By viewing on demand, Nilesat also provides many services such as: technical support services for broadcast stations, which includes adjusting antenna directions, adjusting transmission capacity and allocating a space for external broadcast services with a capacity of

4 and 8 megabytes with the provision of encryption service as well as making terrestrial links to and from Nilesat And Maspero and the Media Production City through the Fiber Nilesat room and also through the main control room in the Media Production City and the possibility of receiving from other satellites, as well as receiving through fixed antennas with the (C & Ku) system and transferring them to the client's headquarters. All systems are fully automated from entering content and even broadcasting with support Complete for SD, HD, and 4K systems through a master control room for each TV channel

The Egyptian satellite Nilesat 301

The Egyptian Company for Satellites Nilesat signed a contract with the French company Thales Alenia Space to manufacture the latest Nilesat communication satellites Nilesat 301, which will help increase the coverage of the Egyptian satellite by providing new frequencies in the frequency space ku in the current marketing coverage area in North Africa and the East In addition to covering the countries in the southern part of the African continent and the Nile Basin, the new satellite will also provide broadband communications services over the Arab Republic of Egypt in the ka band. The manufacture of the new satellite depends on the Spacebus 4000-B2 platform, and the moon will weigh about four tons at The launch and it will be designed to operate for more than 15 years, providing support to strengthen communication services and direct digital broadcasting to become the fourth satellite after Nilesat 101, 102 and 201

Satellite Egypt Sat 2

The CEO of the Egyptian Space Agency revealed the imminent completion of the construction of the satellite assembly center in the Egyptian Space City near the new administrative capital, and it will be completed during the month of April 2022, and added that the launch of the satellite "Egypt Sat 2" will be in December 2022, which is the first satellite It will be assembled at the assembly center located in the Space City, in accordance with the strategy set by the agency regarding the Egyptian space program. Measuring the climatic considerations of African countries, limiting their dangers,

TV broadcasting and TV picture quality

To get the highest possible TV picture quality through broadcast and TV viewing, you should do: TV screen evaluation to check resolution and refresh rates HDR and TV screen location, review TV settings, select between cable TV, satellite TV or streaming

The question that arises here is can satellite be better than cable? The answer is yes and no because cable is more reliable than satellite but it is cheaper because building cable infrastructure is very expensive because thousands of feet of cable need to be laid for one part of one city compared to putting a satellite in the sky to serve a much larger area and therefore more customers Satellite can also have better picture quality because cable providers have to compress the signal and this generally limits its quality so whichever type of TV service you choose there are going to be some trade-offs.

The difference between the picture quality of Internet broadcasting and that of cable TV

The video quality of online streaming services is much clearer than that of cable TV because most cable TV offers 1080i resolution (interlaced scan) while in the case of Internet streaming services they use devices like Roku or Google Chromecast which usually offer 1080p resolution (progressive scan).

The future of satellite television broadcasting

With wide media coverage of services like Netflix, OTT is expected to be the undisputed future of TV distribution models. To increase by about 4% over the next three years, broadcasters continue to choose satellite distribution for its wide range to offer a large number of channels and reach more audience in a more cost-effective manner than OTT, and satellite is considered the preferred choice for Africa due to the remote nature of many of households in Africa as well as the minimal infrastructure required to support the quality of domestic and international television viewing. It is an opportunity, not a threat as the satellite provides a new way to reach thousands of homes and expand their audience

Analysis of digital TV research shows that in mature markets, the number of subscribers to pay-TV satellite channels will continue to remain stable over the next five years while the number of subscribers to free-to-air satellite channels increases, and 5G is still too expensive for broadcasters and does not provide Currently the coverage they are looking for So satellites will always be needed to feed 5G heads and many consumers will not be able to afford 5G in its current form, the total number of TV homes is expected to increase by more than 70 million to 1.76 billion by 2023 and when it comes to With satellite reception, an additional 20 million homes will have access to the satellite, bringing the total to 450 million by 2023. to viewers via satellite.

The future of TV broadcasting

eMarketer states that the projected time to watch TV in 2023 will continue to decline, while 2020 in particular was an anomalous year for TV as people spent more time watching TV news about the pandemic and US elections which increased the amount of time spent watching TV For the first time since 2012, according to eMarketer, this trend will reverse as we progress as the average US adult spends 15 minutes less on average in 2022, and 11 minutes less in 2023. According to MarketingCharts, May 2021 data from Nielsen shows that TV households were spending more time broadcasting than they were watching broadcast TV and eMarketer also estimated that by 2024 the number of such households will grow even more, reaching 46.6 million. Connect (OTT) as many TV stations expand their news coverage on OTT delivery platforms such as Apple TV and Roku This creates a huge opportunity for local TV stations and OTT news content must include something more than standard webcasts. Live coverage along with a library of Related pre-produced videos that keep viewers engaged, must provide quality and timeliness of information as well as make connections to and with users with attention to education and transparency, another change that is happening now includes the entry of more broadcast networks into SVOD which is Subscription Video On Demand, Figure (5) It shows

the time spent watching media from 2019 to 2023 and a comparison between analog and digital media.

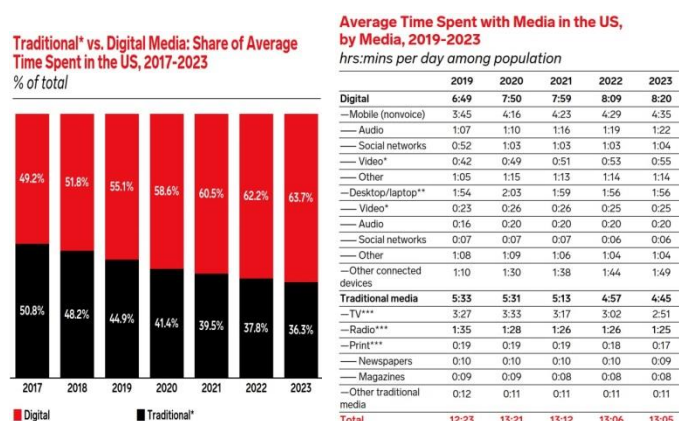


Figure (5) shows the time spent watching media from 2019 to 2023 and a comparison between analog and digital media

Research results

- 1- The digital video image goes through three stages to be able to display it on the screen, which is the stage of preparation, distribution, and then broadcasting
- 2- Television broadcasting is what is done by digital television broadcasting networks, cable television or via satellite, while streaming is television broadcasting through IP in the form of IPTV or OTT
- 3- There are many classifications of TV broadcasting methods and types, including analog TV, digital broadcasting, enhanced TV, hybrid broadband, terrestrial TV, CCTV, outdoor broadcasting, and direct broadcast satellite
- 4- Satellites play an important role in the technology of digital terrestrial television broadcasting and television broadcasting through IP
- 5- The Egyptian TV broadcasting technology keeps pace with the latest global TV broadcasting methods thanks to the development of broadcasting and communications technology used in addition to the establishment of a satellite assembly center in the Egyptian Space City
- 6- The quality of the video provided through online video streaming is better than that of cable TV video due to the different TV scanning systems between them
- 7- The spread of the Corona epidemic led to an increase in the area of TV media coverage, which led to an increase in the viewership rate on the traditional TV screen, and the year 2020 became the highest viewing rate for TV channels

Recommendations

- 1- To get the highest possible quality of the TV picture through the broadcasting and TV viewing processes, some steps must be taken, which is to evaluate the TV screen for resolution and refresh rates to be 120 Hz or above the range, support HDR, check the location of the TV screen and TV settings, and make sure from the connection ports, and in the case of a 4K TV, you must make sure that it has HDMI 2.0 ports
- 2- TV broadcasts must be able to offer different quality levels such as going from standard TV quality to HDTV HDTV signals may use newer and more spectrum-efficient encoders but they

are not compatible and can be broadcast simultaneously with a traditional quality version to serve traditional receivers and HDTV receivers at the same time

Providing DTTB services in parallel with other means of delivery such as satellite TV, cable TV or IPTV, and OTT broadcasting services.

3- DTTB must be compatible with existing 6, 7 and 8 MHz TV channels and the choice of broadcasting system will depend on specific conditions such as spectrum availability, coverage requirements, existing network structure and reception conditions

4- The TV broadcast streams must be changed to HEVC or IP transport streams along with MPEG-2 or MPEG-4 streams to implement the distribution of DTTB encoded signals between studios and encoders and then to the transmission sites to ensure stable transmission rate synchronization

5- Work must be done to develop and increase the space for using satellite technology in broadcasting operations, because it represents the heart of the transmission process for the video image in all its forms

6- When thinking about buying a TV, make sure that it is equipped with TV tuners for one or more types of distribution: cable, satellite, terrestrial, IPTV or OTT, and that the actual refresh rate is 120 Hz or more.

References

- Walter Fischer, " Digital Video and Audio Broadcasting Technology: A Practical Engineering Guide", Springer Nature, Jan 3, 2020
- Handbook on digital terrestrial television broadcasting networks and systems implementation, 2021 edition, International Telecommunication Union, Radiocommunication Sector,
- [Md Tapon Mahamud Jony](#), Satellite Broadcasting Fundamentals, Lulu.com, Dec 13, 2019,
- Dr. Djazia Bayau, "Foundation of TV production", e-Kutub Ltd, London, 2021,
- <https://en.wikipedia.org/wiki/Broadcasting>
- <https://sapec.es/tv-contribution/>
- <https://www.mbaskool.com/business-concepts/marketing-and-strategy-terms/17828-broadcast-television.html>
- <https://en.wikipedia.org/wiki/Broadcasting>
- <https://wikidiff.com/transmit/broadcast>
- <https://www.emarketer.com/content/us-time-spent-with-media-2021>
- <https://www.reviews.org/tv-service/how-to-get-tv-on-the-road/>
- <https://castr.io/>
- <https://en.wikipedia.org/wiki/Broadcasting>
- https://link.springer.com/referenceworkentry/10.1007/978-0-387-78414-4_240
- <https://sapec.es/path-to-the-video>
- <https://www.haivision.com/resources/streaming-video-definitions/video-contribution/>
- <https://sapec.es/tv-distribution/>