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Participant Handbook

Sector
Electronics

Sub-Sector
Communication & Broadcasting

Occupation
After Sales Service

Reference ID - **ELE/Q8101, Version 1.0**
NSQF Level 4

DTH Set-top Box Installer and Service Technician

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"Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission."

Shri Narendra Modi
Prime Minister of India

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Certificate

COMPLIANCE TO

QUALIFICATION PACK - NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

ELECTRONICS SECTOR SKILL COUNCIL OF INDIA

for

SKILLING CONTENT : PARTICIPANT HANDBOOK

Complying to National Occupational Standards of

Job Role/ Qualification Pack: **"DTH Set Top Box Installer and Service Technician"** QP No. **"ELE/Q8101, NSQF Level 4"**

Date of Issuance : March 10th, 2018
Valid up to* : March 10th, 2020
*Valid up to the next review date of the Qualification Pack or the 'Valid up to' date mentioned above (whichever is earlier)

Authorised Signatory
(Electronics Sector Skill Council)

Acknowledgements

The need for having a standard curriculum for the Job Role based Qualification Packs under the National Skills Qualification Framework was felt necessary for achieving a uniform skill-based training manual in the form of a Participant Handbook.

I would like to take the opportunity to thank everyone who contributed in developing this Handbook for the QP DTH Set-top Box Installer and Service Technician.

The Handbook is the result of tireless pursuit to develop an effective tool for imparting the Skill Based training in the most effective manner.

I would like to thank the team of KontentEdge for their support to develop the content, the SME and the team at the ESSCI along with the industry partners for the tireless effort in bringing the Handbook in the current format.

CEO

Electronics Sector Skills Council of India

About this Book

This Participant Handbook is designed to enable training for the specific Qualification Pack (QP). Each National Occupational (NOS) is covered across Unit/s.
Key Learning Objectives for the specific NOS mark the beginning of the Unit/s for that NOS.

- Understand the basics of DTH technology
- Know the DTH market, future and Government regulations
- Describe the DTH market, future and Government regulations
- List the different types of tools used for installing the dish
- Identify the correct methods of using the tools
- Maintain and handle tools properly
- Identify antenna assembly components used in DTH installation
- Explain the use of components in DTH installation
- Describe the consumables used in DTH setup
- Plan for installation of DTH on site
- Identify the potential mounting sites for antenna assembly
- Install antenna for DTH
- Identify the aspects of suing correct body language
- Explain the do and don'ts at work place

The symbols used in this book are described below.

Symbols Used


Key Learning Outcomes


Steps


Time


Tips


Notes


Unit Objectives


Practical


Activity

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1. DTH – The Technology

Unit 1.1 – Introduction to Basic DTH Technology

Unit 1.2 – Introduction to DTH Terminologies and Components

Unit 1.3 – DTH and Other Services

Unit 1.4 – Government Regulation, Market and Future of DTH

ELE/N8102

Key Learning Outcomes

At the end of this module, you will be able to:

1. Understand the basics of DTH technology
2. Know the DTH market, future and Government regulations
3. Describe the DTH market, future and Government regulations

UNIT 1.1: Introduction to Basic DTH Tech nology

Unit Objectives

At the end of this unit, you will be able to:

1. Identify the requirements for schools to enable smart classes
2. Define the structure of smart classrooms
3. Identify the basic DTH technology and display products

1.1.1 DTH (Direct to Home)

Direct to home is a technology which provides satellite television broadcasting for direct reception broadcast for the customer premises. The DTH technology basically refers to the direct broadcasting satellite technology. This technology was develop ed to compete with the local cable TV service. It provides high quality satellite signal and many other value-added services (VAS) such as interactive channels, MOV (Movies on Demand) and television shopping directly to a user's home via a satellite link directly to customers premises.

The following figure shows the DTH technology network:

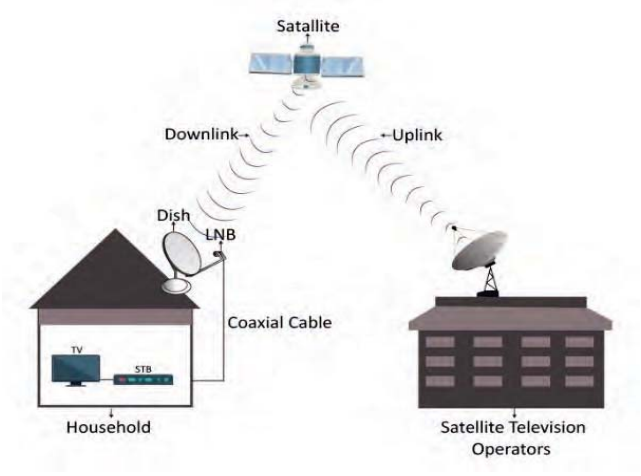


Fig. 1.1.1: Basic DTH network working

1.1.2 Components of DTH Network

A complete DTH network comprises of a programming source, broadcast centre, satellite, dish and receiver. The following figure shows the basic steps followed in a DTH set up:

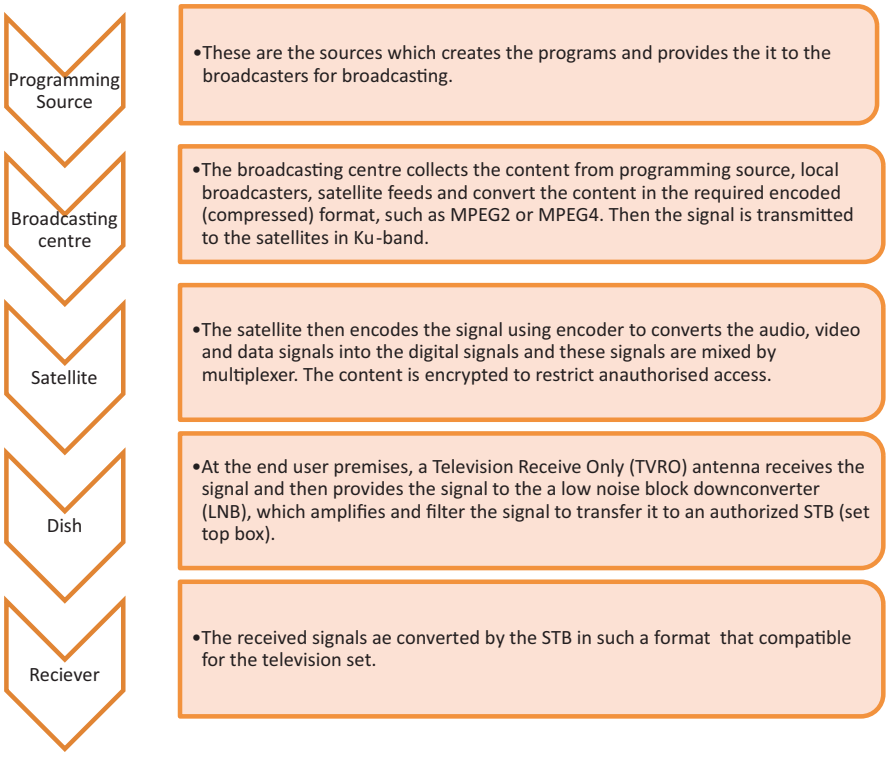


Fig. 1.1.2: Steps in DTH Technology set up

The following diagram shows the steps involved in DTH service working:

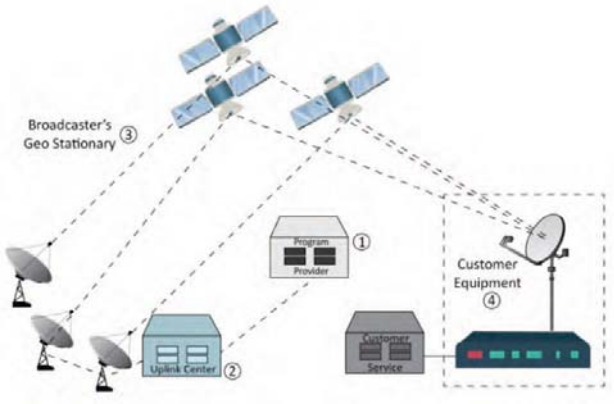


Fig. 1.1.3: Steps involved in DTH working

1.2.3 Working of DTH

The transmission of compressed programs from the broadcaster to the consumer passes through several stages. The following figure shows the steps involved in working of DTH service:

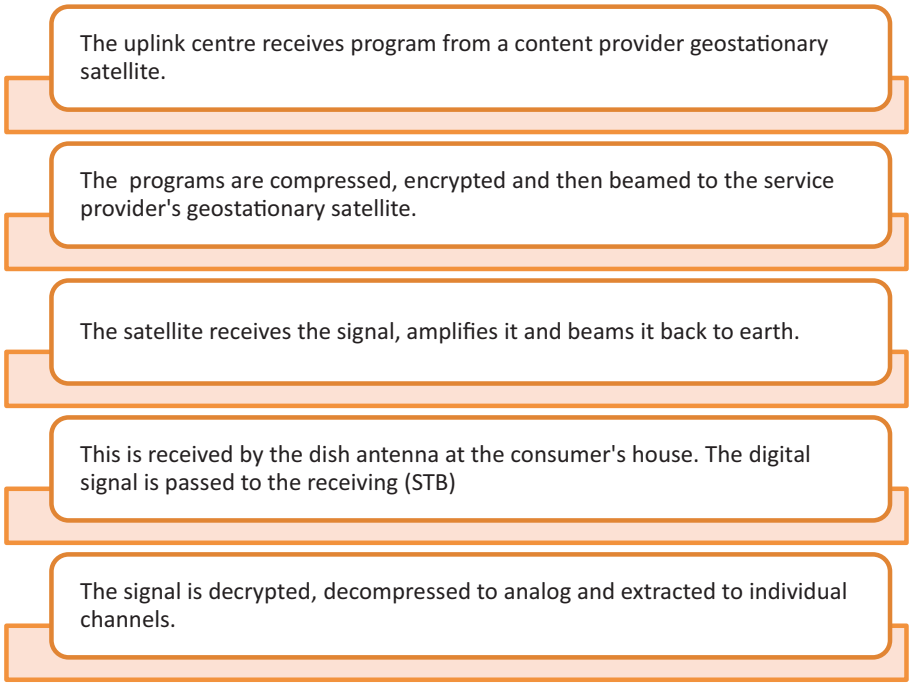


Fig. 1.1.4: Steps in working of a DTH service

The components required at the customer's site to receive the signals through satellite are:

- A dish antenna to catch signals from the satellite.
- A low noise block down (LNB) converter amplify the signals and filter out the noise.
- A set top box (STB) to convert digital signals to analogue signals.
- A co-axial cable to connect the STB to the TV.
- Other components such as connectors, viewing card, RG 6 cable and remote control.

Some prominent features of DTH:

- DTH bypasses the Cable operator and comes directly to our houses from broadcasters through satellites.
- It provides services to the remote areas where cable network is difficult to reach.
- It allows the users to pay only for the channels and services they have subscribed.
- It provides an advanced viewing control that allows the customer to check the current and scheduled programs for future.

- It provides high quality picture and sound to consumers and VAS (Value added services) like interactive games, internet access, movies on demand etc.
- It allows the broadcasters to restrict the piracy of the broadcasted content.
- It is a cost-effective measure as there is no mediator like cable service providers.
- As the DTH market has large number of competitor's consumers are free to choose service providers as per their convenience

1.1.4 History and Development of DTH

The following figure shows the major development years of DTH technology over a period time:

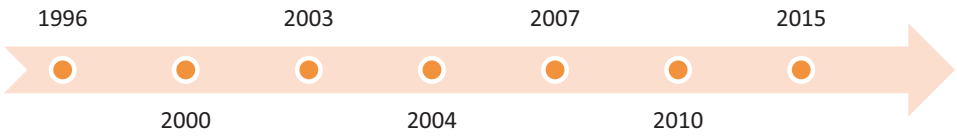


Fig. 1.1.5: DTH development years

The major development in the preceding years was:

- 1996 – DTH services was proposed in India. But next year Government banned the services as it was not approved because of the concern of the national security and negative cultural influence.
- 2000 – In November, Government of India allowed direct to home television broadcasting service with rules and regulations for the players to enter in the DTH market of India.
- 2003 – In October, first DTH service was launched by Dish TV in India.
- 2004 – In December, public broadcaster Prasar Bharati launched a free service known as DD Direct Plus (now DD Free Dish) which offers only free-to-air channels.
- 2007 – The Telecom Regulatory Authority of India (TRAI) issued the Telecommunication (Broadcasting and Cable Services) Interconnection (Fourth Amendment) Regulation 2007 which are the rules are broadcasters need to follow.
- 2010 – In the beginning of the year, Sun direct started offering India's first high definition service.
- 2015 – In January, Videocon d2h started providing India's first 4K ultra HD channels.

1.1.5 DTH in the Indian Scenario

As per the data on December 2016, there were a total of 97.05 million registered DTH subscribers, of which 62.65 million were active subscribers. This makes India the biggest market of DTH in the whole world as per the subscribers count.

In India there are over 167 million households which have TV sets. In which, 161 million households have access to cable TV.
(As per the research by TAM Universe update of 2015)
The Indian DTH industry is predicted to expand at Compounded Annual Growth Rate (CAGR) of 16% for 2016-2020.
(As per 'Indian DTH Market Outlook 2020' report)

Following are the names of a few DTH providers in Indian:

1. TATA Sky
2. BIG TV
3. Sun Direct DTH
4. Dish TV
5. Airtel DTH
6. Videocon DTH
7. Reliance

The following figure shows the market share of a few DTH providers in Indian market:

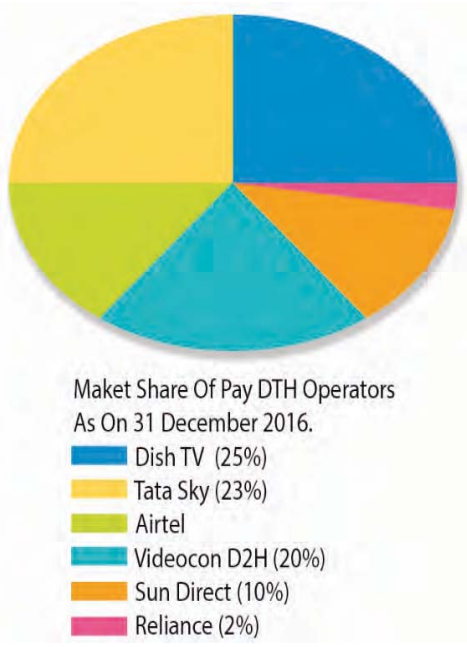


Fig. 1.1.6: Market share of DTH operators in India

In November 2016, Videocon d2h and Dish TV agreed on merger of their DTH operations. After this merger the entity known as DISH TV Videocon Limited, is the largest market player in Indian DTH market.

The Telecom Regulatory Authority of India (TRAI) was set up in February 1997 by an Act of Parliament. The authority regulates telecom services and tariffs in India and provides a fair and transparent environment that facilitates fair competition in the market.

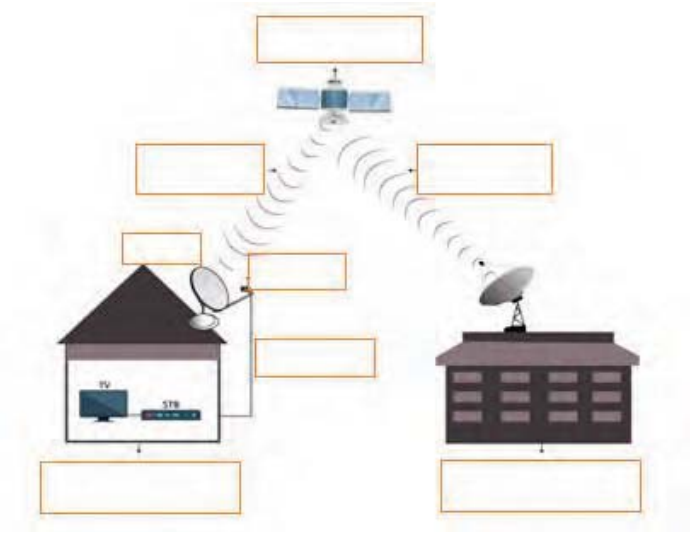
All DTH services in India are currently using the Moving Picture Experts Group (MPEG)-4 standard of signal compression as per the TRAI regulations.

1.1.6 DTH Future

- DTH will be the leading entertainment delivery technology owing to digitalization of content and wider audiences.
- Mobile DTH (In planes, SUVs, trains) and also on mobile phones is the future.
- Higher end interactive programme, wider range of content will dominate the scene and would be the key differentiator.
- 5K TV – It takes the resolution of 4K and adds extra width of 21:9 which makes it a wide screen display.
- TRAI will soon allow interoperability between DTH service providers and cable service providers allowing customers to switch from one operator to another. This will give more freedom to the customers to choose the service provider they like and not compelled to buy services from the one from whom they have purchased a set top box.

Activity

Look at the following image and label it.



UNIT 1.2: Introduction to DTH Terminologies and Components

Unit Objectives

At the end of this unit, you will be able to:

1. Describe the terminologies used in DTH technology.
2. Understand the components and consumables used in DTH set up.

1.2.1 DTH Terminologies

Some terms specific to DTH technology are shown in the following figure:

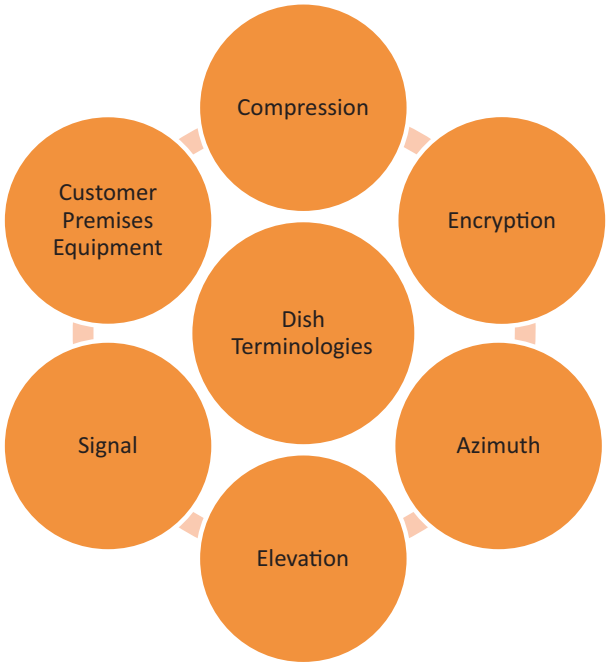


Fig. 1.2.1: DTH related terminologies

Compression

The size of programs made for television is huge and transmitting them is difficult and time consuming. Therefore, compression is used to make the size of these programs small.

A typical satellite has the capability to transmit about 200 channels with digital compression. Whereas it can transmit about 30 channels without digital compression. MPEG-1, MPEG-2 and MPEG-4 are a few of the compression technologies used to compress satellite signals.

The latest one among these is MPEG-4. A few features of MPEG-4 are:

- It is a collection method which defines the compression of audio and visual (AV) digital data.
- It includes many features of MPEG-1 and MPEG-2 and other related standards and further adds a few new features such as better compression, better picture quality and resolution.

Encryption

Programs that are transmitted can be illegally received and viewed by people. To prevent such a practice, content providers use encryption to code program signals. These signals can be decoded or decrypted by only those persons who have the correct decryption algorithm and security keys. This decrypting mechanism is built into the Set Top Box of the consumers. So, this makes unauthorized access difficult.

Azimuth

Azimuth angle is used to calculate the possible position of an object in the sky, with respect to a particular observation point. The observer is generally (but not necessarily) stationed on the earth's surface.

In case of DTH, Azimuth Angle is the angle at which the earth station satellite dish is fixed in comparison to the point of reference, measuring clockwise from true north. It is fixed to correctly point towards the satellite for receiving the best possible wireless signal from the orbiting geo stationary satellite. So, we can say that Azimuth specifies the rotation of the full antenna over a vertical axis. It is also called as a side to side angle. Generally the main mount bracket is unscrewed and whole disk is rotated all the way around in a circle of 360 degrees.

To rotate dish horizontally to track the satellite is called azimuth setting. It is measured with a Magnetic compass.

Elevation

The angle of elevation (el), also known as the altitude, of an observed object is determined by measuring the vertical angle between the consumer's dish antenna and the satellite. In other words, elevation specifies the angle between the pointing direction of the dish (directed towards the satellite) and the local horizontal plane and is an up-down angle.

Elevation setting is the method in which the dish is rotated dish vertically, so the satellite can be traced. It is measured with an Inclinometer.

The following figure shows the azimuth and elevation angles for DTH dish set u p:

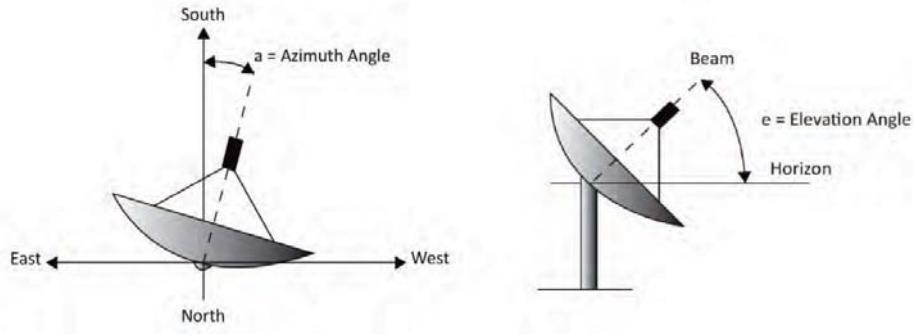


Fig. 1.2.2: Azimuth and elevation angles for DTH dish

Signal

A signal is communication system which is used to transfer information, data or any type of content from one place to another place.

The following figure shows types of signals:

Digital Signal	Analog Signal
•This type of signal is constructed from discreet set of waveforms to represent sequence of discreete signals.	•These are continuous signal in which the time variable of the signal is a representation of other time varying quantity.

Fig. 1.2.3: Difference between digital and analogue signal

Polarization

Polarization is the orientation of signals being received and broadcast by satellite transponders and antenna. In order to make maximum use of the transponder bandwidth, two different data of sa me frequency are transmitted over same transponder by simply transmitting them at different polarities i.e. one beam is vertically polarized while other is horizontally polarized. Polarity of a given beam is decided by the direction of the magnetic field developed by wave.

Antenna polarization is used to effectively broadcast and receive signals.

The following figure shows the types of polarization:

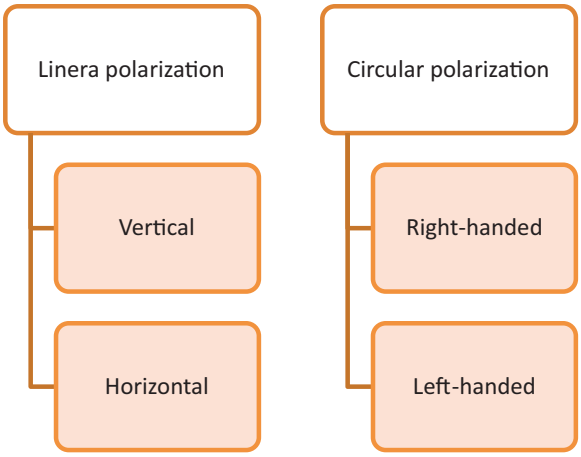


Fig. 1.2.4: Types of Polarization

To receive maximum signal clarity, the broadcasting antenna mounted o n a satellite and the receiving antenna mounted at the consumer home should be set for the same polarization.

Polarization of antenna can be done by mounting the m to be aligned with each other or adjusting the LNBF of the receiving antenna.

The following figure shows the horizontal and vertical polarised waves in x-y-z axis:

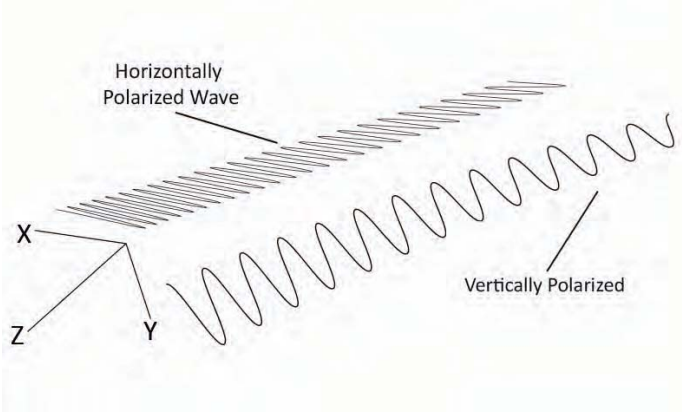


Fig. 1.2.5: Types of Polarization

Spectrum Allocation

A spectrum can be defined as the group of various types of EM radiations of different wavelengths. These are the radio frequencies over which all signals like mobile communication, GPS, DTH etc. travels.

The allocation of this spectrum is very important to make sure free operation of the spectrum service. Without affecting the quality of the service over the spectrum.

C-Band

C-band was the first frequency band allocated for commercial ground-to-satellite communications. It is that portion of the electromagnetic spectrum that lies between 400 MHz and 1000 MHz (4 to 8 GHz)

Ku Band

KU Band is the band of frequency ranging from 12 to 18 GHz. This is a very high band of frequency which is used by DTH to transmit signals. DTH uses KU Band to transmit signals from uplink centre to the geostationary satellite which is 36000 km away from the earth above the equator. As KU Band is a very high frequency band it can travel this distance with less deterioration.

Signal Level

Signal level refers to the strength of wireless signals received from a satellite. The signal level will be good if there is no obstruction in the path of its travel and the antenna is correctly pointing towards the satellite.

Satellite Foot Prints

The footprint of the communication satellites can be defined as that ground area which its transponders cover. It helps in determining the satellite dish diameter which is required to receive any transponder's signal. Each transponder (or a group of transponders) generally have a different map as each map is aimed to cover different areas of the ground.

The outer contours of the foot print match the geographical boundaries of the area intended to be covered. The power of signals reduces as we go farther from the centre of footprint.

Tracking

Tracking is the process of adjusting the position of the dish antenna in the satellite's direction so that it can face the satellite correctly. This is done to achieve optimum signal strength.

Up Linking

Up linking refers to the transmitting of wireless signals from an earth station to a satellite for re transmission.

Down Linking

Retransmission of wireless signals from a satellite to a ground station is called down linking.

LOS

A clear line-of-sight (LOS) should be there in between the satellite which is broadcasting the signals and the dish antenna at the consumer's home. Blockage of wireless signals coming from the satellite can occur if there is an obstruction such as a hill, a building and even trees. Blockage of signals due to an obstruction in line-of-sight leads to no reception.

The following figure shows the line-of-sight (LOS) for satellite signal:

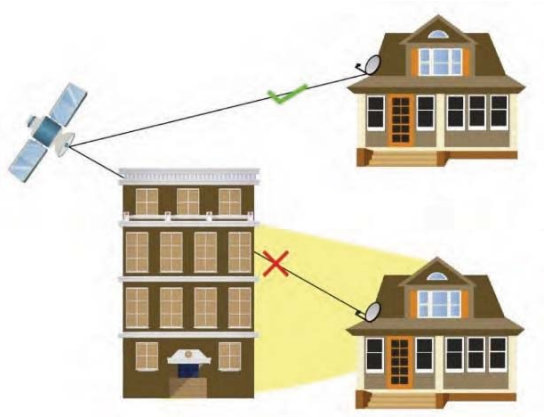


Fig. 1.2.6: Line of Sight for DTH satellite network

Rain Fade

When high frequency signals are transmitted through the atmosphere of earth (from uplink centre to the satellite & then back to earth) it incorporates some losses.

Since the wavelength of very high frequency is very small, the signal while passing through moist air during rainy season incurs heavy losses as compared to dry air. This heavy loss causes the set top box to get lower signals than in normal conditions and may even cause breakdown of signals altogether. This temporary loss of signals during heavy rain is called Rain Fade.

To reduce the rain fade affect, the Ku band system designers use slightly larger size of antennas than required during clear weather thus receiving little higher signals by a set top box than its minimum required level. In coastal regions 70 cm dish antennae is used. The following figure shows rain outage condition:

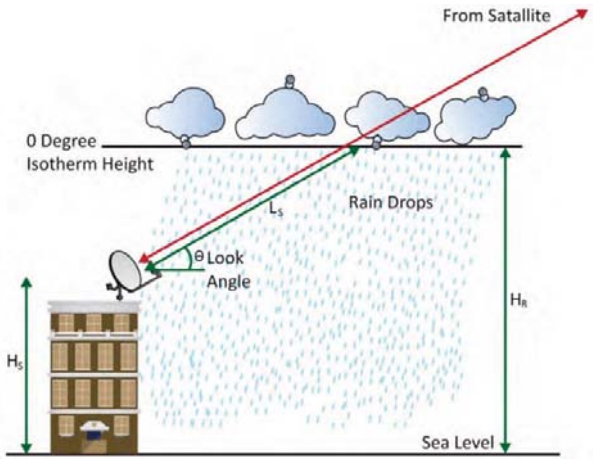


Fig. 1.2.7: DTH signal blockage due to rain outage

Sun Outage

A sun outage can be defined as an interruption or distortion in the signals of the geostationary satellites and is caused due to the interference from solar radiation. This effect because of the sun's radiation which overwhelm the satellite signal. Usually the sun outages occur in months of February, March, September and October, which is around the time of equinoxes. As the sun radiates strongly, it swamps the signals transmitted from the satellite which are in the form of microwave frequencies (C-band and Ku band). The sun outage effects include partial degradation, which is an increase in the rate of error, or total destruction of the signal. The following figure shows sun outage condition:

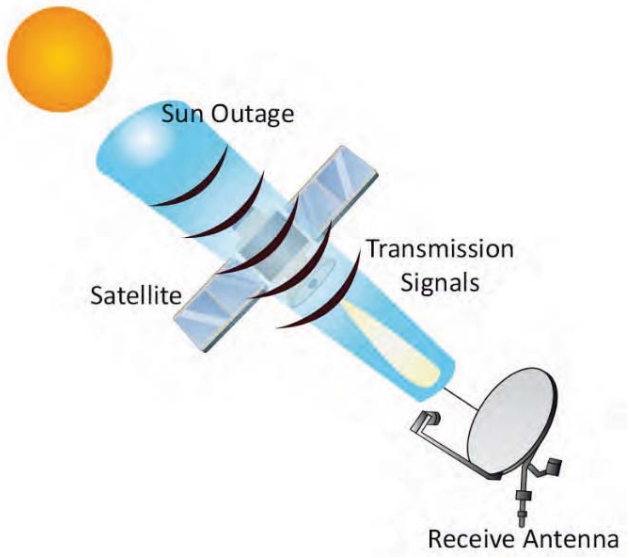


Fig. 1.2.8: DTH signal blockage due to sun outage

CPE

CPE refers to customer-premises equipment. It comprises of the following:

- Satellite Dish antenna which is used to receive signals from a geostationary satellite and reflect it to the LNBF.
- The Set top Box which receives signals from the LNBF and after decrypting, decompressing, separating the channels and converting the signals to analogue signals, it sends them to the television set.
- The viewing card which is inserted inside the set top box. It is used to authenticate the viewer's subscription and its validity.
- The Coaxial Cable which connects the set top box to the television to pass the analogue signals for viewing.
- Connectors which are used to link the cable running form the antenna to the set top box and from the set top box to the television.

- The remote control which is used to perform the set top box functions from a distan ce.
- AAA batteries used in the remote control.
- Audio/Video cable used to connect set top box to the television.
- The LNBF which sends the signals via a cable to the set top box.

The following are the images of some customer premises equipment:

Dish

STB

Coaxial cable

LNBF arm

Fig. 1.2.9: Customer premises equipment

Satellite

A natural or manmade object that revolves around the planet is called satellite. The following is a figure of satellite:

Fig. 1.2.10: Satellite

Satellites can be of the following types:

- Sun-Synchronous Sat – These satellites are in polar orbits. Meteorological satellites are generally positioned in a sun-synchronous or heliosynchronous orbit. Orbits are composed so that the satellite's orientation is fixed with respect to the Sun consistently, enabling exceptionally precise climate forecasts to be made. Most of the meteorological satellites orbits about 15 to 16 times per day around the Earth.